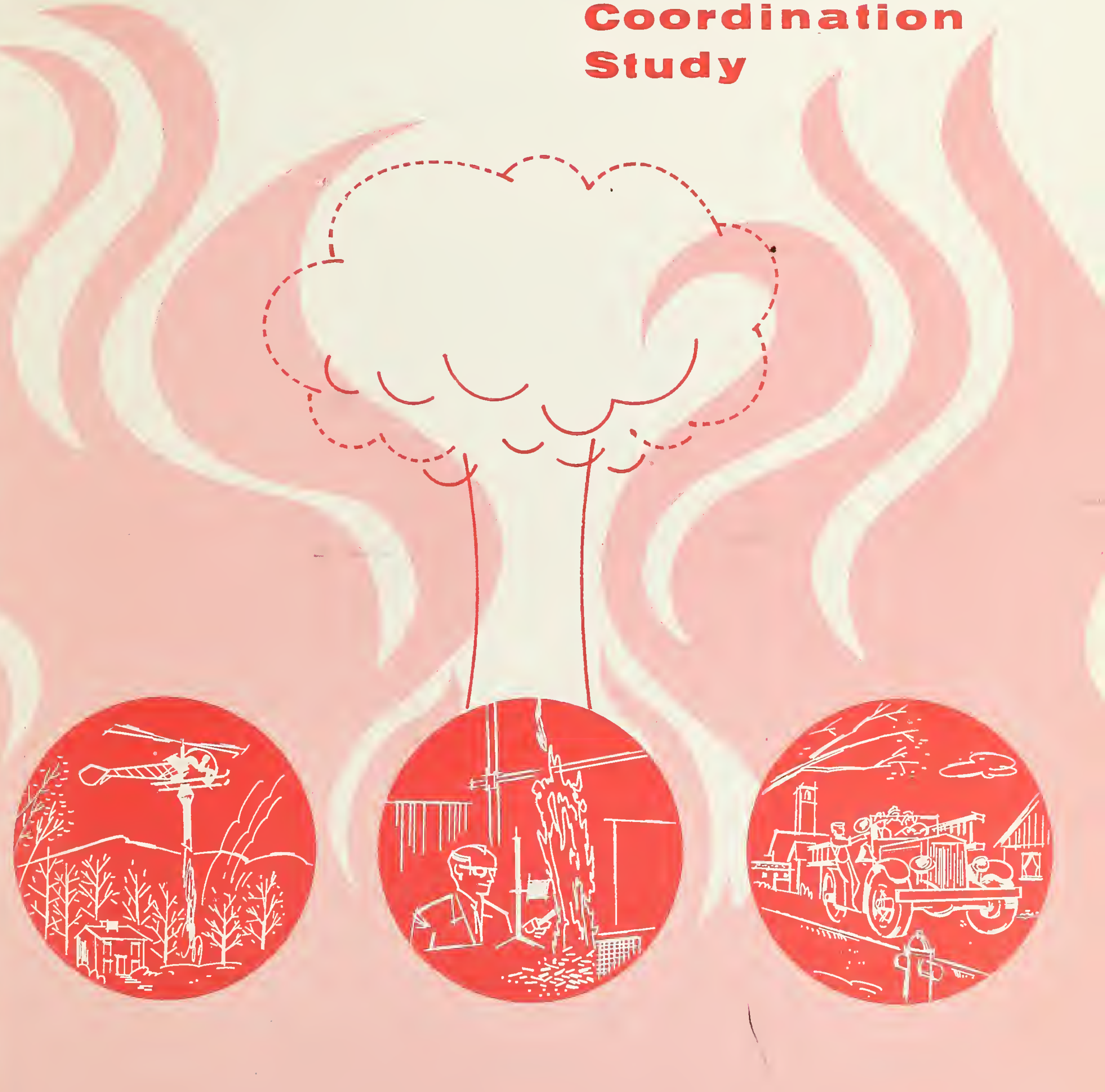
DEFENDING THE UNITED STATES FROM NUCLEAR FIRE

Final Report of the **National Fire Coordination Study**



U.S. DEPARTMENT OF AGRICULTURE / FOREST SERVICE / DIVISION OF FIRE CONTROL

DEFENDING THE UNITED STATES FROM NUCLEAR FIRE

By

William R. Moore
James W. Jay
John H. Dieterich

The Final Report of the

National Fire Coordination Study

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This report has been reviewed in the Office of Civil Defense and approved for publication. The contents do not necessarily reflect the views and policies of the Office of Civil Defense or the U. S. Forest Service.

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PREFACE

This report completes the National Fire Coordination Study. When combined with the Analytical Report and its supporting documents, it establishes a sound technical basis for a much needed program of fire defense. In the report a feasible program is described, including recommended ways to develop and implement it.

Among the persons who worked with the study staff, there was general agreement on the definition of the threat from nuclear fire, the complexity of coping with this fire, and on the need for a fire defense program. But there was not unanimous agreement on some of the measures contained in the proposed program. When differences arose, the study's Forest Service staff made such recommendations as they believed best fit the needs.

Unless there are radical changes in weaponry or significant research break-throughs, changes in basic technical data will evolve slowly. Conversely, the proposed program is flexible. It can be expanded or changed to meet varying needs as they arise. Therefore, the information presented here should provide guidance for defending the United States from nuclear fire for some time to come.

MERLE S. LOWDEN, Director
Division of Fire Control
United States Forest Service

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Mr. Robert C. Byrus, Director, Fire Service Extension
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College Park, Maryland

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U. S. Department of Interior
Bureau of Land Management
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Silver Spring Fire Department
Silver Spring, Maryland

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Maryland Department of Parks and Forests
Annapolis, Maryland

Mr. Paul Lyons
National Fire Protection Association
Boston, Massachusetts

Chief Noel Manchester
Los Angeles County Fire Department
Los Angeles, California

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New York City Fire Department
New York, New York

Mr. George Moorhead
New Jersey Bureau of Forestry
Trenton, New Jersey

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U. S. Department of Interior
Bureau of Land Management
Washington, D. C.

Mr. Donald M. O'Brien, General Manager
International Association of Fire Chiefs
232 Madison Avenue
New York, New York

Mr. Keith Royer, Supervisor
Fire Service Extension
Iowa State University
Ames, Iowa

Chief Lester Schick
Davenport Fire Department
Davenport, Iowa

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Controlling this fire challenged the combined strength of the department including mutual aid from 19 surrounding counties. - Wide World Photos

I INTRODUCTION

On May 22, 1964, minutes after a woman reported a fire by telephone and ended with the words, "I got to get out of here", the Boston Fire Department found itself battling to control the Bellflower Street holocaust which threatened a residential section of the city. Controlling this fire challenged the combined strength of the Department, including mutual aid from 19 surrounding communities (16)*.

Several times each year similar scenes are repeated in cities, towns, and rural areas across the U. S. Each time capable urban, rural, and sometimes combinations of urban and rural fire services personnel joined forces and controlled the monster. The aftermath, however, often leaves personal injuries, loss of life and serious property damage.

*Refer to Bibliography, Section VIII.

What if the Bellflower Street Fire, and similar fires across the Nation occurred as a result of a nuclear attack? Could the fire services, hampered by rubble, broken water mains and radioactive fallout, and harrassed by numerous additional thermal ignitions, contain such fires within acceptable limits? Under such conditions of nuclear attack, containment of the Boston Fire would not have been likely. The fire would have spread through areas of closely-spaced wooden apartment houses, crossed major barriers and spread downwind to threaten a significant portion of the city. Moreover, the fall-out shelters located downwind would have been exposed to the fire; the occupants would have been forced to choose between defending themselves from fire, or fleeing shelter and risking death or serious illness from radioactive fallout (30). The Boston example applies with varying severity to communities in target areas throughout the country and, to a lesser degree, to communities in non-target areas as well. <u>What then can be done before, during and after an attack to reduce the effects of nuclear fire to acceptable proportions</u>? This is the heart of the matter and the reason for the National Fire Coordination Study (NFCS).

PURPOSE AND SCOPE

Fire will be a serious but manageable threat to human lives and important resources if a nuclear attack is launched upon the United States. Using the findings of pertinent research and administrative studies, this report describes programs to counter the fire threat and presents guidance materials, plans, methods and equipment with which nationwide preparation for defense from nuclear fire can be started. This report is a "State of the Nation" treatment of the nuclear fire problem. It recommends a significant addition to the present programs of the Office of Civil Defense.

Since World War II, much research has been done in the field of nuclear fire. The findings from this research indicated that a fire threat is associated with potential nuclear attack, but previously the full nationwide magnitude of the threat and its associated operational problems were not known. In this report, present day knowledge in nuclear fire research, supplemented by administrative studies made during the NFCS, is utilized to develop comprehensive programs of fire defense for the nation.

Although the report provides information of value to operational fire leaders, fire educators and civil defense officials, its primary purposes are to establish a sound technical basis for a nationwide fire defense program and to provide guidance to the Office of Civil Defense in program development.

PROGRESS OF THE STUDY

The Division of Fire Control, U. S. Forest Service, began the National Fire Coordination Study in July, 1964, at the request of the Office of Civil Defense. The study's purpose was to:

1. Review pertinent research findings and define the nuclear fire problem.

2. Recommend a nationwide fire defense program, including alternatives.

3. Recommend means of implementing the parts of the program chosen by OCD.

The study was conducted in two phases, with OCD management officials evaluating the conclusions and recommendations of Phase One before Phase Two began. Phase One defined the nuclear fire problem and recommended alternative programs to cope with it. It concluded with issuance of the Analytical Report (Classified CONFIDENTIAL) (63) and the companion unclassified Phase One Report (64). These reports show that a fire defense program is needed and that enough information is available to give substance to a program.

The Phase One Report recognizes that the nuclear fire problem is serious. It describes three alternative fire defense programs for consideration by OCD - Austere, Moderate and Comprehensive programs. It recommends that OCD initiate the Austere Program first, expanding later into the Moderate or Comprehensive Programs. With minor adjustments, OCD accepted this recommendation and authorized the Forest Service staff to proceed with Phase Two.

During Phase Two, the results of Phase One were further substantiated. Problems of defending community fallout shelters from fire were defined more precisely and measures were included in the program to strengthen shelter defense. Major attention was given to procedures for conducting the

improved Austere Program. Drafts of the Fire Chapter of the Federal Civil Defense Guide were written; they included a statement of fire defense policy, guidance for analyzing the nuclear fire threat to each community, a national fire defense plan, and training programs. Prototype equipment was developed to help fire dispatchers assemble, assign, and account for fire equipment and manpower resources during a disaster.

APPROACH

Several analytical investigations were performed during the study. Nuclear attacks of varying weights and types were hypothetically employed upon the United States; pertinent research findings were applied to these attacks and the fire problem was defined. Thirteen large urban and rural fires were studied and the findings were related to defending fall-out shelters from fire. Samples of current fire planning and readiness activities were obtained by studying fire mutual aid arrangements in California, Oregon, Michigan, Massachusetts, and the Washington, D. C. metropolitan area. Related operational studies conducted in the past were reviewed and their recommendations were considered.

Results of these analytical studies were used to identify protective measures, support activities and training programs which could help reduce the threat from nuclear fire. Through cost-effectiveness analyses, the most productive counter-measures were selected and arranged into alternative fire defense programs. From the beginning, the Forest Service staff had the assistance of fire experts from urban and rural fire services, fire supporting organizations and fire educational organizations. Thus, research in the field of nuclear fire, damage assessment of potential enemy attacks, information from mutual aid and large fire studies, and the thinking of many fire leaders across the Nation have been joined to analyze the nuclear fire problem and recommend solutions.

ORGANIZATION OF THE REPORT

The most significant findings, conclusions, and recommendations of the National Fire Coordination Study are set forth in the Summary Chapter. They are followed by a Chapter relating the fire threat and fire defense to other major components of the Civil Defense Program. Chapter IV contains

guidance for implementation of the proposed program. Chapter V deals with the important concept of utilizing necessary fire defense measures for maximum benefit during peacetime; it also provides information to help OCD differentiate, for cost-sharing purposes, between Nuclear Fire Defense measures and normal peacetime fire control measures. Protective measures and equipment are treated in Chapter VI. In the last Chapter, the nuclear fire problem is described for target and non-target areas. Operational guides, drafts of proposed Federal Civil Defense Guides and a development schedule for the Fire Defense Program are included in the Appendix.

DEFINITIONS

The following list of definitions apply specifically to the contents of this report:

Atmospheric Transmissivity A variable property of the earth's atmosphere for changing the amount of radiation reaching the earth surface from a nuclear detonation.

Conflagration A fire involving a large area of simultaneously burning fuel having a moving fire front. Direction of spread is generally with the prevailing wind and is influenced by topography as well as available fuel.

Countermeasures (See Protective Measures)

Exposure Fire A fire resulting from direct radiant heat exposure from nearby burning fuel.

Extraordinary Measures Protective measures, support activities, and training required for fire defense, in addition to normal peacetime fire control activities.

Fires Those fires resulting directly or indirectly from enemy attack, including both urban and rural area fires.

Fire Defense The total concept of defending lives, property, and resources from fires during an enemy attack.

Fire Defense Program The combination of extraordinary preparation and operations employed to prevent, contain, or curtail the destructive effects of fires during and following an attack.

Fire Defense Training Training required for fire defense, in addition to normal peacetime fire training.

Fire Education Organizations Organizations whose objectives are to educate and train personnel in the professional and technical aspects of fire prevention and control.

Fire Load, Fire Loading Refers to the potential heat energy of combustible materials per unit area. May be expressed in pounds of combustibles per square feet or Btu. per square foot.

Fire Services Organized urban and rural fire departments and services currently engaged in preventing and suppressing fires.

Fire Storm A large area of fire with heavy fuel loading having a stationary fire front. Strong winds develop on the perimeter of the fire and blow inward increasing fire intensity.

Fire Supporting Organizations Organizations whose primary objectives are to support fire services, establish fire standards, or increase the professional ability of fire services.

Fire Threat The fire threat to lives and resources stemming from nuclear attack, complicated by accompanying blast and fallout.

Flying Brand A burning piece of combustible material carried from the fire by wind or convection currents.

Lives Exposed to Fire Risk Persons threatened by fire to the extent they are forced to choose between defending themselves from fire or fleeing shelter and risking possible death or serious illness from radioactive fallout.

Local Areas County, city, fire protection, district or combination of these established for tactical fire defense planning.

Mass Fire A large area of burning fuel resulting from the merging of several separate fires.

Mutual Aid Two-way assistance by fire departments of two or more communities freely given under pre-arranged plans.

Nuclear Fire Analysis An analysis of the nuclear fire threat to each community, and inventory of each communities' capabilities to cope with the threat, and an evaluation of the effectiveness of alternative protective measures for each community.

Nuclear Fire Problem The total problem presented by nuclear fire including the fire threat and the problems of coping with the threat under conditions imposed by blast and fallout.

Primary Fires Those fires resulting from the direct thermal pulse of a nuclear weapon.

Protective Measures Those active and passive measures applied on-site to prevent, control or prepare to control fires, including measures to: reduce ignition points; reduce thermal effects; reduce fire vulnerability to fallout shelters; organize fire suppression and related rescue activities.

Rural Areas Forests, other wildlands, flammable croplands and rural communities not under the protection of legally organized fire departments or districts.

Secondary Fires Those fires that develop as a result of nuclear blast damage, accidents, or other natural causes associated with the interruption of normal peacetime activities.

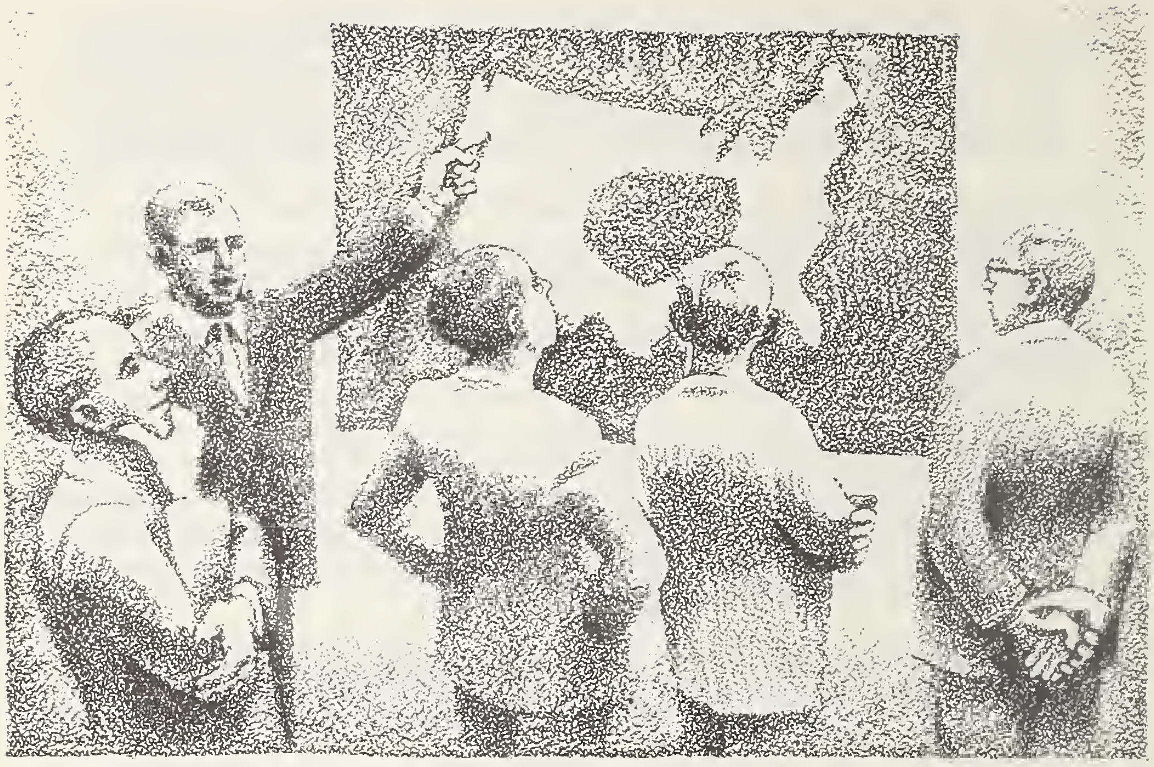
Support Activities Plans or guides necessary to execute the protective measures, including off-site staff support and service.

Target Areas Geographical areas potentially effected by nuclear detonations, as described in Part A, Chapter 1 of the Federal Civil Defense Guide.

Thermal Radiation Heat energy released from a fire; travelling in a straight line; relatively unaffected by wind or convection currents. May be modified by glass, smoke, barriers, etc.

Training Systems The whole process of imparting the desired knowledge from beginning through effective performance by the trainee, including description and arrangement in sequence of the methods, techniques, equipment, and aids to be used.

Urban Areas Towns, cities, municipalities, or other legal entities under the protection of organized fire departments.



II SUMMARY

For the country as a whole, fire would be a significant causative agent in the loss of lives and resources resulting from a nuclear attack. With the population in residences, fire would be a less significant threat to lives than blast and fallout, because the overwhelming effects of blast and fallout would leave fewer persons alive to be threatened by fire. Conversely, a well-sheltered population could face a major threat from nuclear fire. If shelters are available and used, more persons would survive the effects of blast and radioactive fallout; thus, more persons would be alive to be threatened by fire. Depending on weather, fuel conditions, and the weight and nature of the attack, as much as ten percent of the land area of the United States could burn; this would threaten communities and resources needed for the Nation's recovery (64).

In target areas, the threat from nuclear fire would be complicated by blast damage. If surface burst weapons are used, the resulting radioactive fallout could require personnel to seek the shelter within 30 minutes. In the close-in regions of excessive damage, surviving firefighting forces would be considerably restrained in

their operations. Firefighting probably would be generally ineffective and life-saving operations would be limited. Beyond the area of impassable rubble and out to the limit of thermal ignitions, primary and secondary fires would be burning. In this region, selective fire suppression might be undertaken with likelihood of success until fallout forced firemen to seek shelter. Many small fires could be effectively extinguished by citizens before they sought shelter. If threatened, fallout shelters vulnerable to fire would have to be defended or evacuated. The success of shelter protection and fire control would be critically dependent upon a high degree of planning, direction, communication and coordination. Because of the varying effects of weather on natural fuels, fire ignition and fire spread in rural target areas will differ from urban target areas.

In non-target areas, fallout from surrounding nuclear surface bursts might force people to seek shelter. Fire service activity might be limited, but with careful monitoring of radiation levels, shelterees should be able to cope with the accidental fire threatening shelter areas. Studies of four medium-sized cities show the probability of a spontaneous fire during the first day, among the buildings from which the occupants have departed, would be less than ten percent and the occurrence of a fire in a potential conflagration area would be even less likely. If a fire does occur, the principal problem is detection, control and suppression in a contaminated environment.

After a nuclear attack, fires would be occurring under extremely difficult conditions. Consequently, in either target or non-target areas, measures taken prior to attack to prevent ignitions are as important as organized fire suppression during and following attack.

AN IMPROVED PROGRAM TO COPE WITH THE THREAT

The program proposed to cope with the threat from nuclear fire is the Austere Program recommended in the Phase One Report, modified by the Office of Civil Defense and improved upon during Phase Two by the NFCS staff.

Recognizing the seriousness of the fire threat, the program offers a minimal approach to fire defense for the United States. Its objectives are to protect sheltered survivors from fire if a nuclear attack should occur, and to provide means of reducing the fire threat to resources needed for survival. When fully implemented, the program would reduce the threat from nuclear fire to acceptable limits and also reduce the life and property losses experienced in peacetime.

The Proposed Fire Defense Program (See Table 1)

Recognizing the peacetime strength of the fire services as the foundation, the fire defense program would begin with issuance of Part E, Chapter 10, Federal CD Guide. Instructions to be included in this chapter plus three major appendices are transmitted with this report. Training would prepare a minimum number of citizens and professionals to protect shelters and critical resources from nuclear fires. OCD would sponsor national level leadership training and would prepare and distribute training materials and aids to fire services and organizations. TV and radio instructions kits would be prepared by OCD and kept in readiness at national networks and key locations in each state. These items would be used to instruct citizens during times of increased international tension or during fire prevention week drills.

Used jointly by OCD, other Federal Agencies and State and local governments, a nuclear fire analysis system would provide planning data for each community. Nationwide planning efforts would be guided by the National Fire Defense Plan, which is Appendix 2, Chapter E-10.

Development of an infrared fire mapping system would continue, eventually becoming part of a nationwide intelligence system. Special studies would provide data for developing nationwide intelligence and communications systems. A system for assessing damage from nuclear fires would be installed. OCD would prepare guides for community planning to reduce the fire vulnerability of cities.

The fire vulnerability of each community fallout shelter would be determined by inspection, and corrective action would be included in a fire defense plan for each shelter. As necessary, fire suppression equipment and auxiliary water would be placed in each shelter and a fire guard could be trained to help the shelter manager carry out the fire plan. When indicated by the inspection, corrective action would include fire-proofing the roofs of buildings housing shelters.

Fire control and associated rescue during a nuclear attack would be strengthened through training, use of air operations, and use of improved fire resource locator equipment.

Table 1

THE PROPOSED FIRE DEFENSE PROGRAM

Major Components of the Program	Fire Defense Measures	Page Ref.	Objectives For The First Three Years	After The Third Year
-FIRE DEFENSE INSTRUCTIONS (Federal Civil Defense Guide)	1. Part E, Chapter 10, Fire Defense	45	1. Establish during the first year	1. Revise policy & Procedure as necessary
	2. Appendix 1, Nuclear Fire Analysis System	45	2. Establish during the second year	2. Revise currently as necessary
	3. Appendix 2, National Fire Defense Plan	45	3. Establish during the first year	3. Revise currently as necessary
	4. Appendix 3, Fire Defense Training	45	4. Establish during the first year	4. Revise currently as necessary
	5. Annexes as necessary		5. Complete all annexes listed in this report	5. Revise annexes as necessary & prepare new ones as need arises
-FIRE DEFENSE TRAINING	1. Advanced Nuclear Fire Leadership Training	52	1. 300 Leaders Trained-Local Programs in 25 States	1. Maintain a base of 550 Nationally Trained Leaders
	2. Basic Nuclear Fire Defense Training	53	2. integrate Fully into ongoing Fire Training	2. Continue as needed
	3. Urban Fire Defense Support Fireman Training	56	3. Have training underway in all states	3. Develop full capability by 10th year
	4. Shelter Fire Defense Training	54	4. Fire guards trained for all community shelters	4. Maintain trained guards for each shelter
	5. Householder Self-Help Training	55	5. Have 1 member trained in 25% of household	5. Continue as needed
	6. Shelter inspection & Rating Training	54	6. Develop capability to inspect shelters	6. Maintain the necessary trained inspectors
	7. Rural Fire Defense Training	56	7. Have training expanded to 25 states	7. Develop full capability by 10th year
	8. Fire Research Seminars	53	8. Begin Nationwide Seminars	8. Hold Seminars as new research evolves
-CITIZEN ACTION	1. Citizen Fire Extinguishing Prevention	60	1. See training above	1. See training above
	2. T.V. & Radio Information Kit	61	2. Test & distribute kits by end of second year	2. Revise kits as necessary
-NUCLEAR FIRE ANALYSIS	1. Nuclear Fire Analysis System	62	1. System developed and operating in all states	1. Encourage localities to complete their analyses
-FIRE DEFENSE PLANS	1. National Fire Defense Plan	71	1. See Fire Defense instruction above	1. See Fire Defense instruction above
	2. Regional, State & Local Fire Defense Plans	73	2. All Regional Plans & 75% of State & Local plans updated	2. Continue as needed
	3. Shelter Fire Defense Plans	73	3. Plans prepared for all community shelters	3. Continue for newly established shelters
-SUPPORT ACTIVITIES	1. Infrared Mapping of Nuclear Fires	78	1. integrate into intelligence system - Develop 25% capability	1. Continue & develop required capability
	2. Guidelines for Community Planning	75	2. Establish guidelines as National Policy	2. Revise as necessary
	3. Nationwide Fire intelligence System	76	3. Design & establish the system	3. Support development of the systems components
	4. Nationwide Fire Communications System	81	4. integrate existing systems into a National System	4. Support development of the systems components
	5. Fire Damage Assessment System	84	5. Establish system in OCD	5. Revise as necessary
-SPECIAL PREPARATIONS FOR DEFENDING SHELTERS	1. Shelter Fire Guards	86	1. See Shelter Fire Defense Training above	1. See Shelter Fire Defense Training above
	2. Shelter inspection & Fire Vulnerability Rating	85	2. All community shelters inspected and rated	2. Continue to make shelters as fire-safe as possible
	3. Fire Suppression Equipment in Shelters	86	3. Establish equipment in all shelters according to plan	3. Continue to make shelters as fire-safe as possible
	4. Fireproof Roofs for Shelter Buildings	85	4. Encourage fireproofing of shelter roofs	4. Continue to make shelters as fire-safe as possible
	5. Auxiliary Water Supplies in Shelters	86	5. Establish auxiliary water according to plans	5. Continue to make shelters as fire-safe as possible
-EMERGENCY OPERATIONS	1. Fire Resource Locator	87	1. Equipment tested & available for purchase	1. Expand use of equipment to non-fire fields
	2. Air Operations	88	2. Finish urban aerial retardant study Train Fire Leaders in air operation	2. Promote use of new operational developments in air activities

While working in harmony with the objectives and procedures of other civil defense endeavors, the fire defense program would provide ways to plan and implement the extraordinary measures needed for nuclear fire. It would not seek to change any organizations, practices or methods used by the fire services in peacetime. Instead, it would provide information, materials, financial help, training and guidance to help the fire services arrange the needed measures. The peacetime fire services are the strength of the program; its success depends upon their support and participation.

DEVELOPING AND IMPLEMENTING THE FIRE DEFENSE PROGRAM

Because nuclear fire presents a potential local and nationwide threat simultaneously, the combined efforts of OCD, the fire services, fire supporting organizations, fire educational organizations, industry, Federal, State, and local governments and the citizens are needed in the fire defense program. To be most effective, the work of each participating individual or organization should be in accord with the program's objectives. Thus, when developing and implementing the fire defense program, OCD should give first attention to those elements which bring unity and purpose to the participating groups--nationwide coordination and organization, national leadership, flexibility, and understanding of the problem by all concerned.

Leadership Organization and Coordination

The authority vested in the Department of Defense by the Federal Civil Defense Act of 1950, as amended, and Executive Order 10952 seems appropriate for providing national leadership to the fire defense program. The responsibility for carrying out these authorities has been delegated to the Secretary of Army and in turn to the Director of the Office of Civil Defense. Guidance in this section, consequently, assumes that OCD accepts this leadership role. If it is decided to arrange national leadership in some other way, however, the report's recommendations are not negated. Instead, they would apply with equal force to whatever organization assumes the assignment.

To launch and sustain the proposed program, OCD should assign or contract for the necessary professional fire staffs required for national leadership. Fire defense coordinators should be assigned to local jurisdictions, zones within the State as necessary, states, interstate regions and at National Headquarters. They would provide flexibility and liaison between jurisdictions. Each coordinator

should be a qualified fire official who commands respect in his area of responsibility. During peacetime, each would guide readiness activities in his respective area. In wartime, each would assess the relative severity of the fire situation and arrange aid to fire disaster areas in which local fire forces were unable to cope with the situation.

Under the assumption that OCD installs the Fire Defense Program as a major part of the Civil Defense System, this report presents a nationwide fire defense organization (Figure 1) which is compatible with the overall Civil Defense Organization shown in Part A, Chapter 2, Federal Civil Defense Guide. In addition, the report describes alternative fire organizations which permit expansion of the fire staffs at Emergency Operating Centers as required by the emergency. Publishing the above organizations in the Federal Civil Defense Guide and subsequently installing fire coordinators at National Headquarters and OCD Regional offices would constitute the first steps to creating a nationwide fire defense organization.

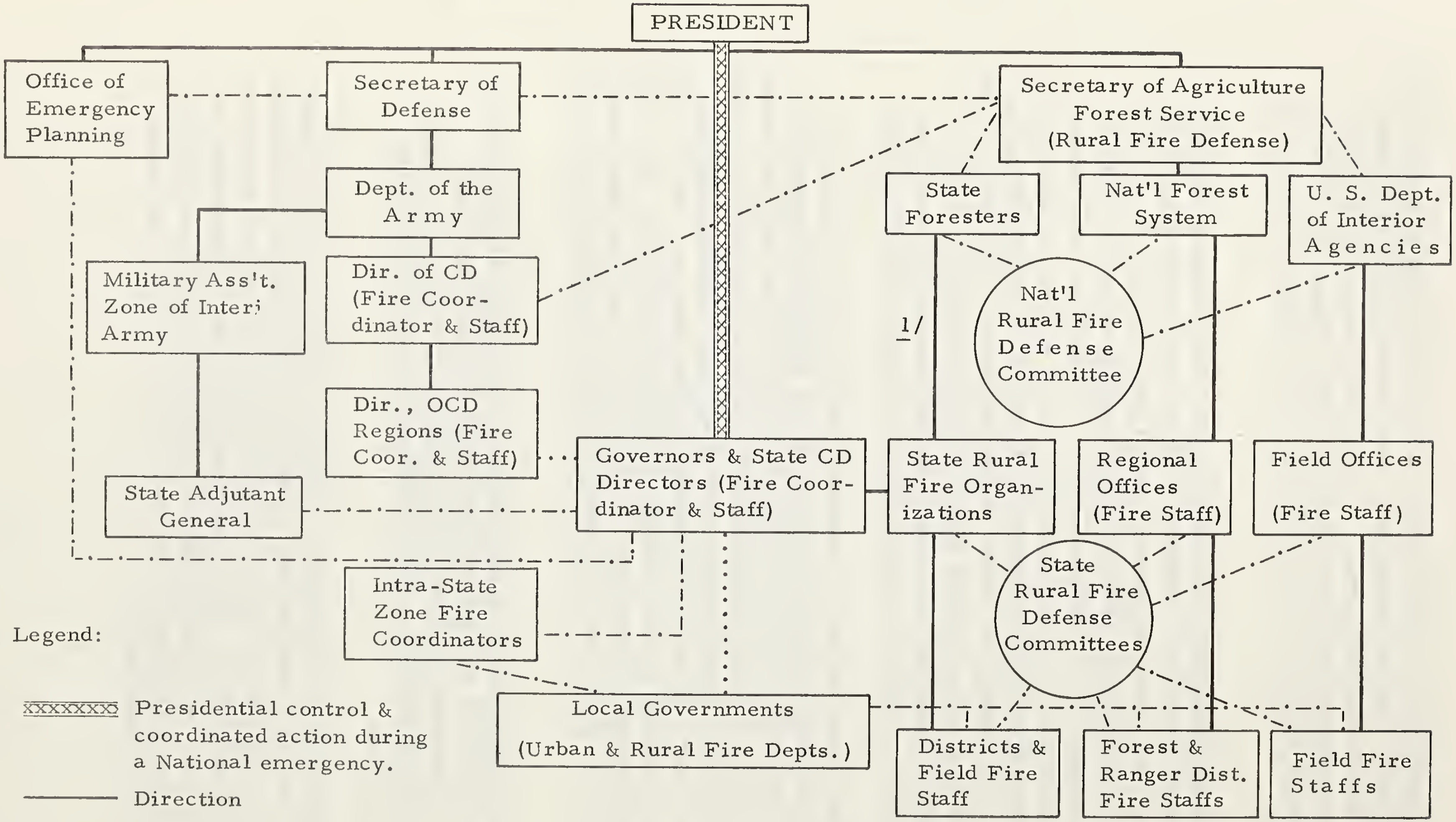
Another aspect of the report is recommendation of a mutual aid policy which would encourage states to enact legislation permitting governors to establish free interchange of fire forces and personnel within each state, and between adjoining states as necessary. Moreover, the policy would encourage mutual aid and training between urban fire services, State and local rural fire services, and Federal fire services, including cost-sharing by OCD for planning extraordinary arrangements for nuclear fire. OCD could assist in implementing the mutual aid policy by publishing it in the Federal Civil Defense Guide.

To coordinate development of the proposed fire defense program, a National Fire Defense Advisory Committee to OCD would be established. The existing Rural Fire Defense Committee, which advises the Forest Service, would continue as a sub-unit of the National Committee.

With professional fire leadership in OCD or under its supervision, and a system of fire coordinators established throughout the nation, OCD would be prepared to guide development and implementation of the fire defense program. The program should be implemented on a sustained basis. In the long run, it will be far better to begin in a modest way and make steady progress than to start a big program and sustain it intermittently.

Figure 1

PROPOSED ORGANIZATION FOR FIRE DEFENSE



Legend:

XXXXXXX Presidential control & coordinated action during a National emergency.

——— Direction

· · · · · · Coordinated planning, emergency operations, Federal assistance.

—·—·—· Coordinated planning & emergency operations.

Rural fire defense activities are coordinated with other defense activities through USDA state and county defense boards.

1/ This relationship would be coordination for states where State Foresters are not in charge of Rural Fire Defense activities.

Carrying on the Program

Using materials from Appendices A, B, C, and D, OCD could launch the Fire Defense Program by publishing Part E, Chapter 10, of the Federal Civil Defense Guide and its major appendices. This would provide policy and interim guidance to the fire services, fire educational organizations, fire supporting organizations, civil defense officials, State and local governments, industries and Federal agencies. By finishing all annexes to Chapter E-10, complete instructions would be made available within three years. (See Development Schedule for the Fire Defense Program, Appendix G)

Meanwhile, training materials should be prepared. Because the threat from nuclear fire is not widely understood, it is necessary initially to provide training in basic nuclear fire defense so the program's participants will better understand the problem and provide added support to the program. Follow-up training could follow the pattern shown in Table 1. OCD would be responsible for conducting or sponsoring Nuclear Fire Leadership Training and the Fire Research Seminars. For other training, it would prepare, test, and distribute the materials and aids; the training would be performed by the fire services, civil defense officials, or fire educational organizations as appropriate. OCD should make provisions for evaluating the results of all training and updating materials as needed.

In the early stages of program development, training of the general public would be supplemented by preparation and distribution to radio and TV outlets of kits containing film strips and recordings with which citizens can be instructed on what to do when an attack threatens. The kits could be prepared by contract.

Through either contract or in-house efforts, OCD would develop a nationwide nuclear fire analysis system. Using the results of the analysis and guided by the National Fire Defense Plan, regional, State, and local units would prepare fire defense plans, or update existing plans, including provisions for defending each community shelter from fire. To aid local units, sample fire defense plans would be prepared.

When developing infrared mapping capability for wartime, cooperation would be continued with the U. S. Forest Service, and pilot operational programs would be conducted in states or regions. Later, infrared mapping would be integrated into a nationwide intelligence system to be designed by OCD under contract. The fire defense requirements would be related also under contract to existing communications networks and plans would be made for a nationwide fire communications system as required. The fire damage assessment system could be developed, meanwhile, through an in-house effort. The fire communications, intelligence, and damage assessment systems would be installed by the third year of program development. By that time, guidelines for community planning could be prepared, reflecting OCD policy for planning fire safe communities.

Early in the program, utilizing work done by Factory Mutual Research Corp. and I.I.T. Research Institute, OCD would, by contract, prepare the handbook to guide local units in inspecting and rating the fire vulnerability of fallout shelters. After inspection and rating, shelters would be made as fire-safe as possible. A shelter fire defense plan would be prepared by local officials; it should include fire protection equipment and auxiliary water requirements for each shelter. Subsequently, the fire guards qualified by the training program described earlier would be available to help the shelter manager carry out the shelter's fire defense plan.

Since air operations would substantially aid the fire service during a nuclear attack, state governors and CD directors would be encouraged to inventory available aircraft and plan their requirements for fire defense. The use of aircraft for fire defense would be included in Nuclear Fire Leadership Training. Meanwhile, OCD could sponsor a study to determine more precisely the effectiveness of aerially-applied retardants on fires in urban areas.

By the end of the program's third year, the prototype Fire Resource Locator Equipment submitted with this report would be tested, and if proven satisfactory, made available. OCD could accomplish the testing by cooperating with the U. S. Forest Service to complete an operational model, constructing up to ten operational models under contract, then arranging for field tests with urban and rural fire services. After completion of the testing and improvement, arrangements would be made to produce the equipment commercially.

SPECIAL PROBLEMS

The proposed Fire Defense Program provides means for meeting many of the problems presented by nuclear fire. However, there are several special problems whose solution would contribute toward more effective fire defense and produce peacetime benefits as well. The problems are summarized below, although not necessarily in order of priority:

1. Data are not presently available to balance the Fire Defense Program with the protective capabilities of other defense activities. An optimum program of fire defense consequently has not been clearly defined. A study is needed to determine the expenditure level at which investments for fire protection reach the point of diminishing returns in comparison with military actions.

2. Analytical work in this study was limited to assessing the program's effectiveness in protecting lives from fire risk. Extension of this analytical work to determine more clearly the program's capability to save resources would provide additional valuable information.

3. Public agencies responsible for Civil Defense in the United States do not generally recognize fire as an important damage-causing agent in nuclear war. This is a serious problem, but it can be partly solved by implementing the proposed Fire Defense Program, which includes action to update public agencies on the fire threat.

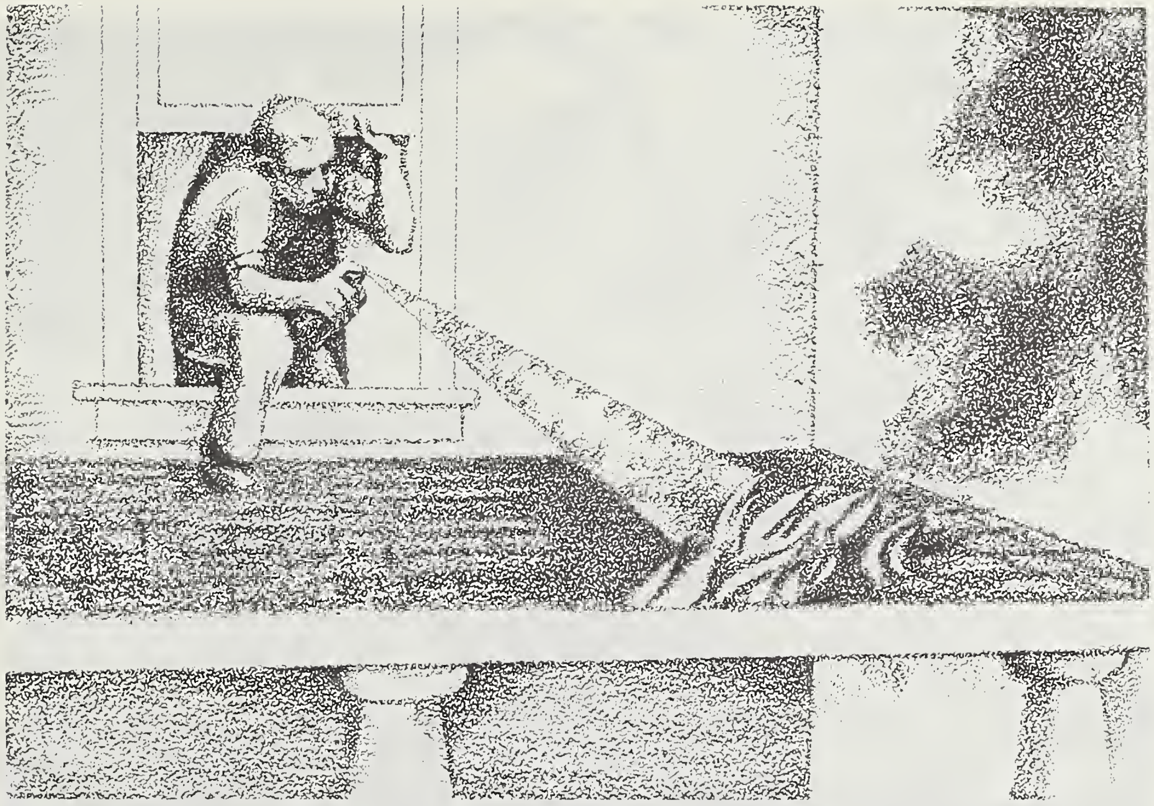
4. The special equipment, or combinations of equipment required to achieve optimum results by firefighting and associated rescue forces in the nuclear attack environment are not known. Special study of this problem is needed, followed by equipment development work as necessary.

5. Responsibility for command of the fire aspects of a nuclear disaster are covered in this report. But the means of assigning overall command of disasters which encompass more than one political jurisdiction are at best unclear. Because overall command would cover all emergency activities in the disaster, the problem is somewhat beyond the scope of this study. Development of a satisfactory means of establishing overall command of nuclear disaster areas would, however, enhance the effectiveness of fire control.

6. During a nuclear attack, collecting adequate weather observations and transmitting weather data to emergency operating centers would be very difficult; reliable collection and transmission techniques must be developed.

7. Many fire research findings are not presently being effectively implemented in operational fire programs. Although some proposals in this report will help, additional means are needed to package research findings for use by operating fire personnel. The Technical Fire Staff Support Center discussed in the Phase One Report would facilitate progress.

8. Existing fire spread prediction models are not fully reliable because of inadequate input data. Continuing research and operations analysis is necessary to identify and assemble appropriate data.



III FIRE DEFENSE IN THE CIVIL DEFENSE PROGRAM

If an enemy launched a nuclear attack on the United States, the results could be: 90 million persons dead from blast, burns, and radioactive fallout; 60 million survivors saved by fallout shelters; and the remainder of the population, only 30 million, not directly effected by the attack! (26) Moreover, the proportion of the population surviving solely because of fallout shelters would become more critical to national recovery as the attacks became heavier. Because of their lifesaving potential, fallout shelters are the foundation of the Civil Defense Program in the United States. Without shelters, the overwhelming effects of fallout would take a heavy toll of persons who survive the effects of blast (63). Consequently, most civil defense systems and operations, including fire defense, would be futile without shelter from fallout.

If an enemy launched a nuclear attack... - Joint Task Force One Photo

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Although the fallout shelter system has potential to save the lives of many persons from initial radiation effects in a nuclear attack, the continued well-being of survivors is not assured unless shelters are protected from the threat of fires. The threat would come from primary and secondary fires and from fires starting from normal sources in non-target areas as people abandon their homes and places of business to seek shelter from fallout. Indeed, the more effective the shelter program, the more survivors from fallout and blast can be expected in areas where fire incidence is high; thus, their protection from nuclear fire becomes progressively more important. The major objective of the fire defense program discussed in this report, therefore, is to protect sheltered survivors from fire. In addition, the program provides the means to reduce the fire threat to resources needed for survival, including protection of the immediate and long-term qualities of the physical and biological environment.

Most civil defense operations would be futile without shelter from fallout. U. S. Forest Service Photo.

The Fire Defense Program is best described as a system capable of reducing the fire threat in harmony with the objectives and procedures of the total civil defense effort. Since the primary damage-causing agents in a nuclear attack - blast, fallout, and fire - are interrelated in many ways, activities in fire defense should likewise be interrelated with other parts of the Civil Defense Program; defense against the total threat posed by nuclear attack is then more likely to succeed.

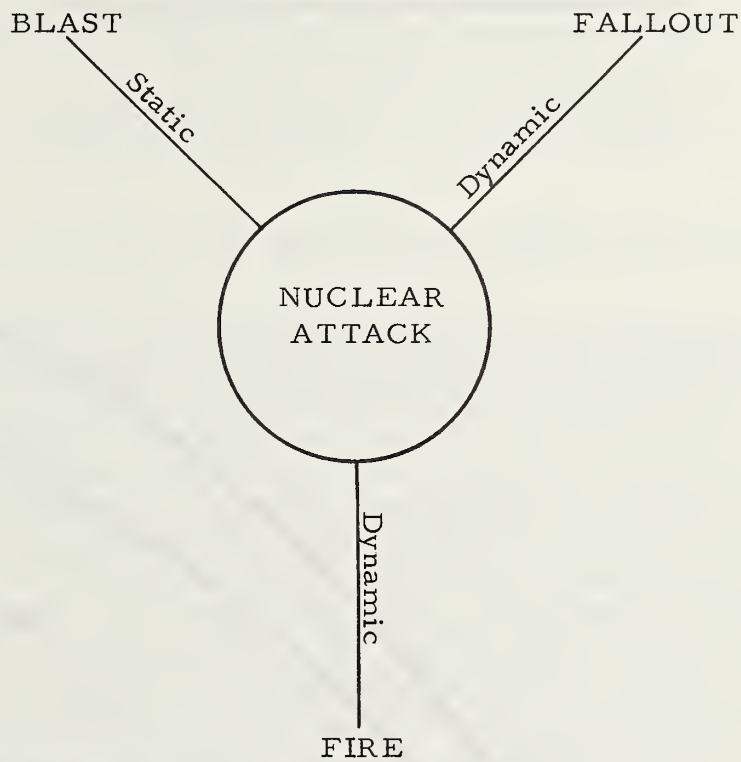
DAMAGE-CAUSING AGENTS AND THE CIVIL DEFENSE PROGRAM

The central problem in nuclear attack is the loss of life and destruction created by the initial detonation of warheads, plus the spreading threat to lives and resources from fallout and fire. It is upon this central problem that the total Civil Defense Program, including fire defense, must focus in an attempt to achieve survival and recovery of the Nation if an attack occurs. Biological and chemical agents, and floods caused by broken dams could also be present during a nuclear attack but these were not dealt with during the National Fire Coordination Study (Figure 2).

Their continued survival is not assured unless shelters are protected from the threat of fires. - Los Angeles County Fire Department

Figure 2

PRIMARY CAUSATIVE AGENTS FOR LOSS OF LIFE, PROPERTY, AND RESOURCES

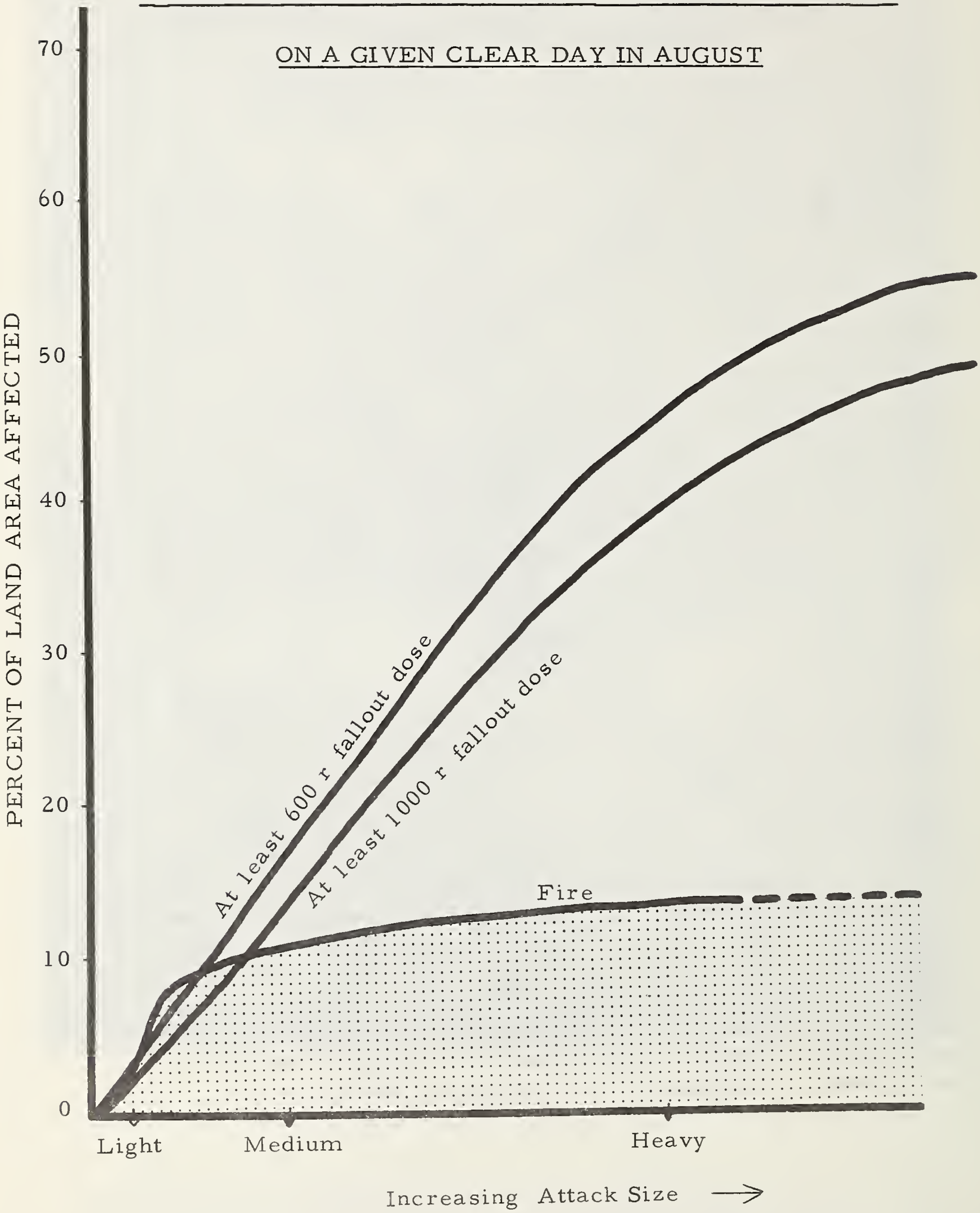


Although blast from a nuclear detonation is capable of creating terrible destruction, it is a static agent and generally cannot spread damage beyond the area of initial effects; dams broken by blast and resultant floods are an important exception. The remaining primary damage-causing agents, fire and fallout, are dynamic in nature and can inflict loss of life and damage to resources for extended periods of time after the detonation and over large geographical areas (Figure 3). Fallout can threaten lives and resources over a greater area than fire, but under certain conditions the threat from spreading fires can be significant far beyond the area affected by blast. Moreover, fires starting in shelter buildings or spreading towards these buildings could force the occupants to defend their shelters from fire or flee into an environment contaminated with radioactive fallout.

Figure 3

ATTACK EFFECTS ON TOTAL LAND AREA OF THE U. S.

ON A GIVEN CLEAR DAY IN AUGUST



Of the several interrelated systems included in the Civil Defense Program, the fallout shelter system and the proposed Fire Defense Program have the most in common. Although establishing an adequate system of fallout shelters is first priority in the logistics of the Civil Defense Program, fire defense should be given comparable consideration if the program is to be fully effective. The way to achieve a balanced Civil Defense Program is for OCD to recognize the nuclear fire threat as national in magnitude and establish fire defense as one of its major programs (Figure 4).

COMPONENTS OF THE FIRE DEFENSE PROGRAM

The proposed fire defense program does not seek to change any organization, practices or methods used in peacetime by the fire services. Nor would it modify any of the fire services' present training programs. Instead, it proposes to provide information materials, financial help, training and guidance so that the fire services themselves can arrange the additional, extraordinary measures necessary to prepare the nation to cope with nuclear fire. Thus, the present capability, procedures and practices of the fire services are the starting points. Recognizing the impossible demands that a nuclear attack would impose on these services, each component of the proposed program seeks to develop additional fire defense strength at the local level as necessary, and at the same time provide means for localities to help quite distant neighbors when possible to do so.

The major components of the fire defense program as shown in Figure 5 are discussed briefly below. Information about implementing the specific measures included in each component of the program is available in Chapter IV.

Organized Fire Services (Component 1). -- Using the guidance provided in the Fire Defense Instructions (Component 2) and Fire Defense Training (Component 3), the organized fire services would play the key role in implementing the Fire Defense Program; upon their support and participation rests the success of all other operational components.

Figure 4

FIRE DEFENSE IN THE CIVIL DEFENSE PROGRAM

Figure 5

MAJOR COMPONENTS OF THE FIRE DEFENSE PROGRAM

The organized fire services would play the key role. U. S. Forest Service Photo.

Fire Defense Instructions (Component 2). -- Although most useful to the fire services and civil defense officials, Fire Defense Instructions (Chapter E-10, Federal Civil Defense Guide, its appendices and annexes) will be helpful to other participants in the fire defense program. They will furnish guidance and procedures for the program to Fire Educational Organizations, Fire Supporting Organizations, Civil Defense officials, State and local governments, industries, and Federal Agencies. The National Fire Defense Plan, which is part of these instructions, coordinates fire activities in localities, states, regions, and at national headquarters in preparing for and coping with nuclear fires.

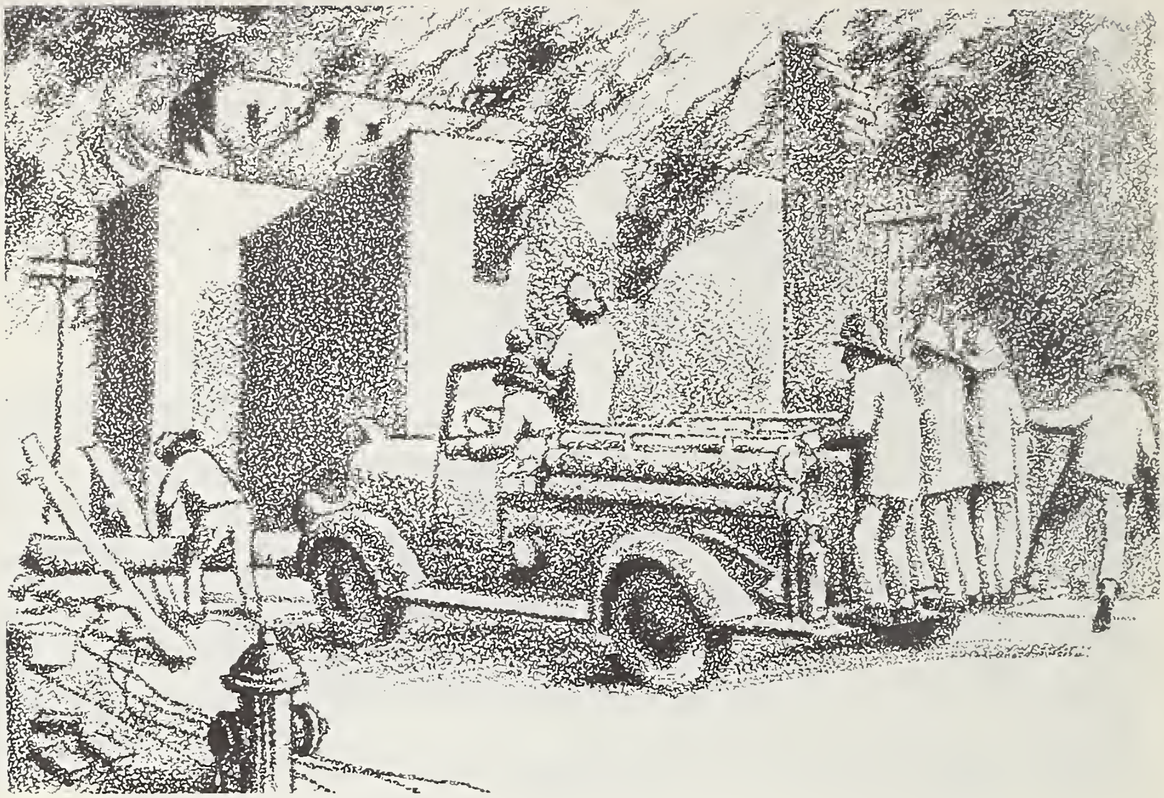
Fire Defense Training (Component 3). -- Fire defense training is necessary to develop understanding of nuclear fire among the general public, fire services and government officials, and to qualify the personnel needed to carry out the program of fire defense.

Because training underlies successful performance in all components of the Fire Defense Program, it should begin promptly after issuance of Fire Defense Instructions (Component 2) and continue as needed to launch preparations for fire defense and keep them current.

Citizen Action (Component 4). -- During and following a nuclear attack, broken water mains and rubble would reduce the effectiveness of conventional firefighting equipment. Fires would be so numerous in some areas that available trained firefighting forces would be quickly overwhelmed. These constraints place a heavy responsibility on the citizens, both individuals and organizations, to support the organized fire services. Utilizing the training given to them by the fire services (Component 3) the citizens should: apply basic fire prevention measures in or near their homes and places of work; activate special citizen protective measures when warned of attack; suppress small fires in or near their homes before taking shelter; aid in suppressing fires within or threatening their fallout shelters; and, as needed and able, aid the organized fire services in fire suppression and rescue tasks.

Nuclear Fire Analysis (Component 5). -- Following the training program (Component 3), OCD, civil defense officials and fire services personnel should begin Nuclear Fire Analysis for the communities and planning areas throughout the United States. Using the Fire Defense Instructions (Component 2), these trained individuals can conduct, or supervise others in conducting analyses of the nuclear fire threat to each community which includes an inventory of each community's capability to cope with the threat, and an evaluation of the effectivenss of alternative protective measures for each community. The results of the Nuclear Fire Analysis are the basis for Fire Defense Plans for each community (Component 6).

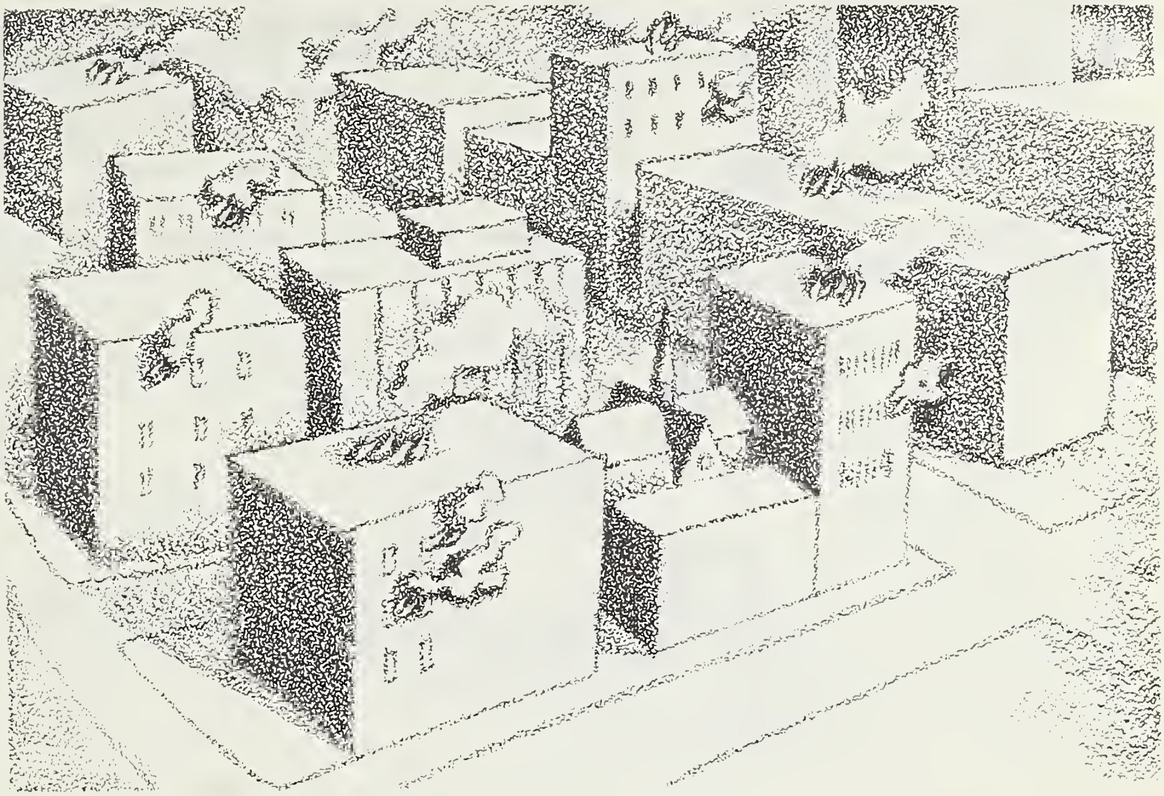
Fire Defense Plans (Component 6). -- Using the results of the Nuclear Fire Analysis (Component 5) and guidance from Fire Defense Instructions (Component 2), a Nuclear Fire Defense Plan should be prepared for each community or fire defense planning area. In addition, plans are needed for state, regional, and national levels of government. The National Plan, which includes guidance for preparing regional, state, and local plans, is discussed in Chapter IV, beginning on page 71.



These constraints place a heavy responsibility on the citizens.

Support Activities (Component 7). -- After the support activities for the community or area are identified in the Fire Defense Plan, those necessary activities which are not already available should be established. In addition to those discussed as major components of the Fire Defense Program, technical staff, communications, intelligence, fire damage assessment, and mutual aid arrangements to deal with the nuclear fire threat identified for the community, are the most common support activities.

Special Preparations for Defending Shelters (Component 8). -- During and following a nuclear attack the threat from fallout could seriously hamper firefighting and movement of people. Coupled with the probability that numerous initial ignitions would occur from thermal flash, these hindrances indicate pre-attack preparations to defend fallout shelters from fire would be especially important. All possible preventative measures should be used. In addition, special arrangements are needed to protect each shelter from fires starting in the shelter or threatening the shelter from outside. Accordingly, fire defense plans (Component 6) should include a plan for defense of each individual community fallout shelter.



Numerous initial ignitions would probably occur from thermal flash.

Emergency Operations (Component 9). -- Fire control and associated rescue is the final phase of the operational Fire Defense Program. Prior to an attack, the incidence of nuclear fire and the likelihood of its spreading beyond the point of ignition would be reduced as much as possible by preventive measures. Guided by the Fire Defense Plan (Component 6) and subject to the constraints imposed by radioactive fallout and blast damage, emergency operations would be employed during and following the attack to reduce the fire threat to acceptable limits.

Research (Component 10). -- Although shown in Figure 5, research in nuclear fire is in practice separated somewhat from the continuity of operational activities. The information already supplied by fire research, however, forms the basis of the fire defense program. Updating the program in the future will depend on new research findings. Several problems requiring research are discussed in Research Summary and Analysis II (32). These and other problems demand continuing emphasis on their important components of the fire defense program.

IV IMPLEMENTING FIRE DEFENSE

INACTION IS TO GAMBLE

Carrying out the fire defense program requires commitment of professional staff time, policy level attention of government administrators, and assumption of responsibility by the general public. It is expensive; the initial phase of the approved Austere Program is not costly, but to develop it fully an investment of $11.7 million before 1970, plus an additional $29.5 million after 1970 (64) would be required from OCD.

Although the program is limited to extraordinary measures for nuclear fire, it is not without peacetime benefits (Chapter V). Indeed, the measures developed to deal with nuclear fire should substantially reduce the number of lives and amount of property lost annually from all fires; the National Fire Protection Association reports that fire losses in the U. S. during 1964 were 11,900 persons killed and property valued at $1.67 billion destroyed.

Until the efforts of OCD and its cooperating governmental agencies establish nuclear fire defense activities in fire service operations, state and local government functions, and as a recognized part of the daily lives of each citizen and corporation, the program of fire defense will not be fully effective. The greatest potential for saving lives and resources is achieved by combining several elements into an integrated whole. Individual elements by themselves are inadequate to deal with the fire threat. Without fully implementing the program, fire defense during nuclear attack will be limited to traditional fire control operations, the effect of which would be reduced by the rubble and fallout resulting from nuclear attack (63).

The program should furthermore be implemented on a sustained basis. Failure to sustain it will destroy the confidence in government leadership which is so necessary to successful civilian participation in our national defense. In the final analysis, it is better to begin in an austere way and continue the program than to mount a more ambitious program and carry it on only intermittently.

THE BLUEPRINT FOR ACTION

Although the Analytical Report leaves little doubt that a program of fire defense is necessary, still unanswered completely is the question of how much insurance from fire threat the program should provide to the public. Data are not presently available to clearly define an optimum fire defense program which would be in balance with the protective capabilities of other defense activities. We do not know how much loss of life and resources from fire can be tolerated without also losing the capability to recover from nuclear attack. The level at which expenditures for fire protection reach the point of diminishing returns in comparison to military investments is beyond the scope of this study. Effectiveness of the recommended fire programs was assessed only in terms of their life-saving capability, leaving analysis of their resource-protecting effectiveness until some future time. Finally, development of some recommended fire protective measures has not advanced to the point that costs, feasibility and effectiveness can be determined with certainty.

Because of these uncertainties, the Phase One Report did not recommend a single optimum program of fire defense. Instead, three programs representing varying degrees of protection against nuclear fire were presented. Of these, the Austere Program included only the most basic and less costly measures capable of reducing the fire threat. The moderate program contained more effective - but more expensive - measures and compressed the implementation period to achieve a greater state of readiness by 1970. The Comprehensive Program would bring to bear on the problem the full weight of present day knowledge of nuclear fire (64).

Since definition of the optimum program was not possible, it seems unwise to incur the expense of the Comprehensive Program. In light of the serious fire threat, however, it is obviously equally unwise to recommend no fire defense program at all. Thus, in addition to presenting three alternative programs for fire defense, the Phase One Report recommended that OCD implement the Austere Program (See Table 2).

OCD approved the Austere Program, with minor adjustments which included: postponing window shielding measures to take advantage of promising research now underway; delaying development of the Nuclear Fire Analysis System to allow time to relate it to OCD's damage assessment system; adding Fire Defense Support Fireman Training (previously included in the Moderate Program); and a Shelter Fire Guard Program which was discussed but not fully investigated during Phase One.

Table 2

ELEMENTS OF THE AUSTERE FIRE DEFENSE PROGRAM

Protection Measures: 1. TV and radio information kit for Citizens' Fire Extinguishing and Prevention Program 2. Low-cost window shielding in shelters and other buildings 3. Shelter Fire Inspection and Rating Program 4. Infrared mapping of nuclear fires
Support Plans: 1. Nuclear Fire Analysis System 2. National Fire Defense Plan 3. Guidelines for community planning to minimize fire spread 4. Nationwide Fire Intelligence System 5. Nationwide Fire Communications System
Training: 1. National Nuclear Fire Leadership Training 2. Rural Fire Defense Training

Meanwhile, investigations during Phase Two by the NFCS staff disclosed measures worthy of becoming part of the Fire Defense Program. These measures are shown in Table 3 and described and evaluated in Chapter VI.

Table 3

ESTIMATED COST AND LIFE SAVING POTENTIAL FOR NEW MEASURES

Measures	Total OCD Cost to Implement	Potential for Saving Lives from Fire Risk
1. Fire Suppression Equipment in Fallout Shelters	$ 12.5 million	Strong
2. Auxiliary Firefighting Water Supplies in Shelters		
3. Fireproof Roofs for Shelter Buildings	$ 17.6 million	Strong
4. Shelter Fire Guards	($ 15,000 development cost only)	Strong

Consequently, the most feasible fire defense program identified so far is the Austere Program recommended in the Phase One Report, adjusted by the Office of Civil Defense, and improved upon during Phase Two by the NFCS staff. Research and operational experience in the future will undoubtedly disclose additional improvements; meanwhile the proposed program offers modest but sound means of defense against nuclear fire. It is the blueprint for action (See Table 4).

Table 4

THE PROPOSED OCD FIRE DEFENSE PROGRAM

MAJOR COMPONENTS OF THE PROGRAM (See Chapter III)	MEASURES FOR FIRE DEFENSE	PAGE REF.
1. Peacetime Fire Service Operations	No special measures necessary except training described below.	
	Fire service personnel are the foundation of the program and should furnish much of the leadership required.	
2. Fire Defense Instructions	Federal CD Guide, Part E, Chapter 10, Fire Defense.	45
	Appendix 1, Nuclear Fire Analysis System.	45
	Appendix 2, National Fire Defense Plan.	45
	Appendix 3, Fire Defense Training.	45
	Additional Appendixes and Annexes as required.	
3. Fire Defense Training	Advanced Nuclear Fire Leadership Training.	52
	Basic Nuclear Fire Defense Training.	53
	Urban Fire Defense Support Fireman Training.	56
	Shelter Fire Defense Training.	54
	Householder Self-Help Training.	55
	Shelter Inspection and Rating Training.	54

Table 4 (continued)

THE PROPOSED OCD FIRE DEFENSE PROGRAM

MAJOR COMPONENTS OF THE PROGRAM (See Chapter III)	MEASURES FOR FIRE DEFENSE	PAGE REF.
3. Fire Defense Training (continued)	Rural Fire Defense Training.	56
	Fire Research Seminar.	53
4. Citizen Action	Citizen's Fire Extinguishing and Prevention Program.	60
	TV and Radio Information Kit for Instructing Householders.	61
5. Nuclear Fire Analysis	Nuclear Fire Analysis System. (See Appendix B)	62
6. Fire Defense Plans	National Fire Defense Plan (See Appendix C)	71
	Regional, State, and Local Fire Defense Plans.	73
	Shelter Fire Defense Plans.	73
7. Support Activities	Infrared Mapping of Nuclear Fires.	78
	Guidelines for Community Planning.	75
	Nationwide Fire Intelligence System.	76
	Nationwide Fire Communication System.	81
	Fire Damage Assessment System.	84

Table 4 (continued)

THE PROPOSED OCD FIRE DEFENSE PROGRAM

MAJOR COMPONENTS OF THE PROGRAM (See Chapter III)	MEASURES FOR FIRE DEFENSE	PAGE REF.
8. Special Preparations for Defending Shelters	Shelter Fire Guards.	86
	Shelter Inspection and Fire Vulnerability Rating.	85
	Fire Suppression Equipment in Fallout Shelters.	86
	Fireproof Roofs for Shelter Buildings.	85
	Auxiliary Water Supplies in Shelters.	86
9. Emergency Operations	Fire Resource Locator.	87
	Air Operations.	88
10. Research	(See Research Summary and Analysis II (32)	

GUIDEPOSTS FOR PROGRAM DEVELOPERS

How can the blueprint for action be extended to become the program for defending the United States from nuclear fire?

The tasks are many and complex. Because the full magnitude of the threat has been only recently defined, it is not widely understood by public officials, public services, industry and the general public. Indeed, nuclear fire is not yet recognized as a primary damage-causing agent by all public agencies responsible for Civil Defense in the U. S. One major purpose of the training programs described later is to bring about the necessary recognition and understanding. As with other aspects of Civil Defense, the complicated relationships between Federal, state and local levels of government are involved. Since the nuclear fire threat is a matter of nationwide concern, unified national leadership and financial support is required to sustain the program to cope with this threat.

The Dilemma of Leadership

Although segmented leadership for fire defense of the Nation is assigned by the President, unified leadership at the national level is not specified. Responsibility for Rural Fire Defense rests with the Department of Agriculture, who has assigned it to the Forest Service. National responsibilities for defending urban areas from nuclear fire are not specifically assigned, but the Department of Defense, through the Federal Civil Defense Act of 1950 as amended, and Executive Order 10952, is assigned responsibility for fire defense as a part of its total Civil Defense Program. These responsibilities have been delegated to OCD.

In the absence of specific assignment for national urban leadership and because Fire Defense is a major part of Civil Defense, the authors recommend that the Office of Civil Defense accept national responsibilities for Fire Defense in urban areas along with coordination of the total Fire Defense Program (Urban-Rural). Consequently, the national leadership so necessary to launch and sustain the fire defense program will become a reality. Guidance presented in this report assumes that OCD accepts this national leadership role.

Although the authors feel that assigning a national professional fire staff in OCD offers the best assurance that a strong nationwide program will result, this staff (discussed in the Phase One Report) is not a part of the proposed Fire Defense Program. Its absence, however, does not obviate

the need for its leadership and services. The technical guidance, national level training, and related services still must be available (64). These categories include:

1. Nationwide aspects of the Nuclear Fire Analysis.

2. Nationwide Nuclear Fire Plans, Samples, and Handbooks.

3. National Nuclear Fire Technical Staff Support Center.

4. National Aspects of Nuclear Fire Training.

5. Problem Analysis for Special Operational Studies.

6. Professional Service in all aspects of disaster fires.

Means by which OCD can implement specific measures in the Fire Defense Program are discussed later in this Chapter. This section provides valuable guidance, but without a strong national leadership staff, the central leadership and services necessary to provide cohesion, unity and continuity to the program are not readily apparent.

Means must be found to close the gap. Since this could involve integrating fire defense leadership and services into the existing OCD organization, it is somewhat beyond the scope of the NFCS.

FLEXIBILITY THROUGH COORDINATION

During the period, August 12-15, 1965, approximately 1,500 fires were set by rioters in a 46-square mile business and residential area of South Los Angeles. More than 600 buildings were burned and looted, including more than 200 totally destroyed by fire. At least 3,000 fire alarms were recorded by the fire services during the disaster. For the first time in California's history a state of Extreme Emergency was declared by the Governor (93).

Fire services, police services, the National Guard, the California Disaster Office, and other individuals and organizations joined forces to cope with the emergency. They eventually brought the riot to an end and controlled the fires.

Thus their preparatory programs, although not without shortcomings, paid dividends when the big emergency came. So it must be with the Fire Defense Program for the Nation; and to achieve effective results in nuclear emergencies, the program should be flexible but unified throughout the U. S.

For the first time in California's history, a "state of extreme emergency" was declared by the Governor. Los Angeles City Fire Department Photo.

As previously explained, fires resulting from a nuclear attack could overwhelm present day firefighting capabilities. Serious fire problems would occur in many jurisdictions simultaneously; in addition, they would overlap jurisdictional boundaries. Some jurisdictions would be relatively untouched by fire. Thus, coordinated readiness arrangements for various jurisdictions to help one another are necessary to achieve effective fire defense operations during and following an attack. If this planning is done, the necessary unity and flexibility will be available.

The capabilities of existing or nuclear-prepared fire services during a national attack can be improved by establishment of a nationwide system of fire defense coordinators. Under such a system, coordinators would be assigned to each local jurisdiction, each zone within the state as necessary, each state, each interstate region, and at national headquarters. Each coordinator should be a qualified fire official capable of commanding respect from fire service personnel and government officials in his area of responsibility.

Since nuclear fire-fighting reliance is placed on locally-situated fire services, with citizens' help, the coordinators would not exercise command, except in serious emergencies under delegation by the Governor of the State or other appropriate official. Command is vested in the operational Fire Chiefs at the local level, the administrators of political jurisdictions in each state, and in governors through emergency statutory authorities.

During peacetime, fire defense coordinators would guide readiness activities in their respective areas. In wartime, they would assess the relative severity of the fire situation and arrange aid to fire disaster areas where local fire forces were unable to cope with the situation. They would provide a powerful unifying force in the fire defense program without unnecessarily diluting the autonomy of existing fire services. The duties and responsibilities of fire defense coordinators are more specifically described in Appendix C.

Sustaining the Fire Defense Program also requires coordinated action between Federal agencies at national headquarters. Because several agencies are involved, coordination of readiness activities should be achieved through committees composed of members of each agency. A National Fire Defense Advisory Committee would be established to advise the Office of Civil Defense in developing the Fire Defense Program. The existing Rural Fire Defense Committee, which advises the Forest Service, would then become a subsidiary unit of the National Advisory Committee. Since OCD will be responsible for urban fire defense, an urban fire defense subcommittee is not considered necessary at this time; the national committee could advise OCD on urban fire defense matters (Appendix C).

With sustained professional leadership plus a system of fire defense coordinators, OCD can serve as a catalyst to carry out a Fire Defense Program. This arrangement permits the expense and workload to be spread among many persons and organizations, thereby achieving adequate protective capability without building up a large centralized staff in OCD. Coordinated efforts must begin at the top, for this coordination will establish a pattern for regional, state, and local fire defense readiness and emergency operations. Herein lies the challenge to the Office of Civil Defense and its cooperating agencies.

INSTRUCTIONS FOR FIRE DEFENSE

Instructions from OCD to participants in the fire defense program are to be in Part E, Chapter 10, Federal Civil Defense Guide. When fully developed, these instructions, appendices, and annexes would provide policies and procedures for conducting all aspects of the program. As a first step in implementing the fire defense program, instructions must be available to guide fire services, fire educational organizations, fire supporting organizations, Civil Defense officials, state and local governments, industries, and Federal agencies. With proper instruction, these services, organizations and agencies can each do their part to obtain reasonable nationwide security from nuclear fire.

Without clear instructions, well-meant efforts will not be completely effective, and the program might splinter and falter. Accordingly, the parent fire defense Chapter and three principal appendices - Nuclear Fire Analysis, National Fire Defense Plan, and Fire Defense Training - are prepared in draft as Appendices A, B, C, and D of this report. Since these instructions were reviewed and revised by several urban and rural fire leaders, they reflect policies and procedures which are considered workable at the scenes of emergencies and at all levels of government.

The instructions have been prepared as though all annexes were finished. However, they can be used now with the slight modifications shown on the Appendices. Thus, they provide means for OCD to furnish interim guidance to the field without delay. Later, the entire system of instructions shown in Figure 6 should be developed and used to guide the program.

Figure 6

INSTRUCTIONS FOR FIRE DEFENSE

PART E, CHAPTER 10 *
FEDERAL CIVIL DEFENSE GUIDE
(FIRE DEFENSE)

APPENDIX 1 *
NUCLEAR FIRE
ANALYSIS SYSTEM

ANNEX 1
NUCLEAR FIRE
ANALYSIS HDBK.

ANNEX 2
REPORTING FOR
DATA BANK
STORAGE

ANNEX 3
PROTECTIVE
MEASURES

ANNEX 4
URBAN FUEL
EVALUATION
GUIDE

ANNEX 5
RURAL FUEL
EVALUATION
GUIDE

APPENDIX 2 *
NATIONAL FIRE
DEFENSE PLAN

ANNEX 1
SAMPLE FIRE
DEFENSE PLANS

ANNEX 2
FIRE DAMAGE
ASSESSMENT
SYSTEM

ANNEX 3
NATIONWIDE FIRE
INTELLIGENCE
SYSTEM

ANNEX 4
NATIONWIDE FIRE
COMMUNICATIONS
SYSTEM

APPENDIX 3 *
FIRE DEFENSE
TRAINING

ANNEX 1
FIRE DEFENSE
TRAINING HDBK.

* Drafts are included in the Appendix.

Annexes Yet to be Written

Because they will contain the detailed procedures and methods for conducting the program, preparation of the annexes for Nuclear Fire Analysis, Planning, and Training should begin soon. Additional research will be necessary to complete at least two. Each annex in the proposed system of instructions is described and its preparation discussed later in the report, as indicated below:

TRAINING FOR FIRE DEFENSE

Training, perhaps more than any other activity, has provided the knowledge and thrust for fire control in the United States. In one way or another, community fire departments have trained

firemen since organized fire control became necessary. For example, following a series of forest conflagrations climaxed by the great fires of 1910, the American public insisted that protective districts be established and trained persons assigned to prevent similar disasters. Since then the burned acres from all forest fires has been steadily reduced, through the cooperation of trained firemen and an informed citizenry.

Fifty-five years later, in August 1965, our analyst studying the Russwood Ball Park Fire in Memphis, Tennessee, said this about training: "Effective training of the hospital staff by the Memphis Fire Department personnel in mass evacuation and fire control contributed materially to the successful handling of this disaster situation." (33)

Training now, as it has over the years, provides the storehouse of knowledge and skills from which the fireman draws strength in an emergency. Valuable property, lives of others, and sometimes his own life, depend on it. During a nuclear attack training would be even more important.

Training currently being done by fire services, fire educational organizations and fire supporting organizations meets peacetime fire control requirements. In addition, some current training is intended especially for the problem of Fire Defense. The Rural Fire Defense Training Program is active in five states. In 1960 and 1961 OCD sponsored staff and command schools where for the first time rural and urban firemen trained together on a national basis. Since then, local versions of this staff and command training have been conducted; they have contributed to improved peacetime capability as well as preparedness for wartime. Meanwhile, training in radiological monitoring, shelter management, community shelter planning and decontamination have added to the knowledge necessary for successful fire defense.

New and different training programs must precede implementation of OCD's program of fire defense, however. Without an understanding of the nuclear fire threat by fire services, civil defense officials, political leaders and the public, neither full acceptance of the program nor adequate preparations are apt to result. Since the nuclear fire threat is unique, extraordinary training is required to prepare the public services and the public to cope with it. Moreover, current research in

Following the great forest fires of 1910, the American public insisted that trained persons be assigned to prevent similar disasters. U. S. Forest Service Photo.

nuclear fire is producing findings which, if utilized oftener by the operational fire services, would strengthen fire defense. These extraordinary requirements have been studied and the necessary training has been made a part of OCD's program of fire defense (Table 5).

The ultimate objectives of fire defense training are to:

1. Provide the qualified fire service personnel and informed citizens needed to successfully implement the fire defense program.

2. Convert pertinent nuclear fire research findings into operational procedures and methods promptly and effectively.

The logistics for achieving these objectives through training are: first, to develop understanding of the problem and the program by the people involved; second, to qualify the personnel necessary to launch the program; and finally, to conduct recurrent training in order to maintain a state of readiness.

To be sure, time, talent and energies are required to develop fire defense training, which everyone hopes will never be tested by an enemy attack. But to be ready is to be armed intellectually and to prepare the Nation for defense from nuclear fire is to uplift the quality of all fire activities. Indeed, fire defense training provides an unusual opportunity to advance fire prevention and control throughout the U. S.

The program for fire defense training is comprised of nine courses shown in Table 5. It is a serious undertaking, but the fire threat is a serious problem and the training presented is the minimum needed. It cannot and need not be all launched at once. Instead, it should be developed in accord with other components of the Fire Defense Program over the time period shown on the Program Development Schedule, Appendix G. Objectives, subject matter, guidelines, and locations for training are shown for each course in Appendix D. The scope and development of each course are discussed briefly below.

TABLE 5 ANALYSIS OF OPERATIONAL FIRE DEFENSE TRAINING NEEDS

1. Fire Defense Objectives ⟶ 2. Tasks to Perform to meet objectives ⟶ 3. People Needed to do the Tasks ⟶ 4. Training Needed [2]

1. Fire Defense Objectives

1. To reduce loss of life and resources from fire to acceptable limits at tolerable costs.
2. Develop & maintain capability to withstand fires resulting from enemy attack.
3. Fully utilize the fire defense potential of the citizens.
4. Conduct fire defense research and development.[1]
5. Employ all feasible pre-attack measures to reduce the fire threat.
6. Integrate nuclear fire requirements to enhance peacetime fire operations.

2. Tasks to Perform to meet objectives

1. Make a Nuclear Fire Analysis of each community.
2. Identify, evaluate, and employ effective protection measures.
3. Implement a citizen's fire extinguishing and prevention program.
4. Inspect, rate, and correct fire vulnerability of fallout shelters.
5. Prepare to defend shelters from within from fire.
6. From without from fire.
7. Take selective organized fire suppression and rescue actions trans & post-attack.
8. Gather fire intelligence trans and post-attack data.
9. Extinguish small fires, wherever they are, before they join and become large fires.
10. Reduce fire spread potential in communities and rural areas.
11. Plan effective fire defense for each community.
12. Currently utilize the latest scientific & technological advances in fire defense.
13. Integrate fire defense activities with the overall management of each disaster area.
14. Integrate peacetime fire operations with defense requirements.
15. Design the systems, equipment, & methods needed for tasks 1 - 14.

3. People Needed to do the Tasks / 4. Training Needed [2]

3. People Needed to do the Tasks	4. Training Needed [2]
1. National Fire Defense Coordinator and Staff 2. Fire experts for disaster Manager's Staff 3. OCD Regional Fire Defense Coordinators and Staffs 4. USDA Regional Office Fire Staffs 5. USDI Regional Office Fire Staffs 6. State Fire Coordinators, Fire Marshals, and State Foresters 7. State CD Directors 8. OEP Regional Office Staff	1. Advanced nuclear fire leadership training. 2. Fire Research Seminar.
9. County & City CD Directors 10. Local Fire Coordinators and Staffs - Urban, Rural, USDA, Forest Staffs, Interior Field Staffs	3. Local nuclear fire leadership training.
11. Rural citizens in organized crews	4. Rural Fire Defense Training
12. Supervisory firemen; urban & rural	5. Basic nuclear fire defense training [3]
13. Citizens to support urban fire services	6. Fire Defense Support Fireman Training
14. Citizens to act independently	7. Householder self-help training
15. Shelter Inspectors	8. Shelter Inspection & Rating training
16. Shelter Managers 17. Shelter Fire Wardens	9. Shelter Fire Defense
18. Military Personnel	10. Training in 1, 2 and 5 above depending on type of assignment.

Footnotes

1 Analysis of tasks, personnel and training needed for fire defense research are not included.

2 In addition to the needs listed, radiological monitoring training as required by local assignment is necessary.

3 This basic knowledge is also required for people listed in Column 3, 1-11.

Advanced Nuclear Fire Leadership Training

Advanced nuclear fire leadership training is intended to give fire professionals, military personnel, and other defense officials with fire background and responsibility, the knowledge they need to plan and implement effective fire defense for states and regions within the framework of the National Fire Defense Plan (Appendix C). In addition, a special option would prepare fire leaders to manage the fire aspects of a large nuclear or natural disaster area. Trainees would already be qualified and responsible for managing peacetime fire control activities in sizeable geographical areas. The training is aimed at supplementing these qualifications with an understanding of the nuclear fire threat, procedures required to analyze this threat, national fire defense policies and plans, methods for planning fire defense, and fire defense operations during a nuclear disaster. It is important to combine training for both urban and rural fire leaders since this establishes the background for later cooperation. Approximately four weeks training is contemplated.

The training would be national in scope. Approximately 550 nationally-trained leaders are required for the fire defense program. Under the supervision of OCD, a combination of training efforts would be necessary to train them - courses at the OCD staff college; contracts with universities having essential staff and facilities and training by the fire services themselves.

Local Nuclear Fire Leadership Training

Local nuclear fire leadership training would be similar to advanced nuclear fire leadership training but would deal with specific local situations instead of national, regional and state situations. It would give fire professionals and other local officials with fire responsibilities the knowledge they need to plan and implement effective fire defense for their respective localities. Trainees would be already qualified in peacetime fire prevention and control, but some might not be qualified to manage large fires. Approximately two weeks training is contemplated.

Local nuclear fire leadership training would be performed jointly by state CD offices and fire services personnel at or near the locality where the trainees have responsibilities. In

some cases, personnel from fire educational organizations could also help with the training. People who would face nuclear fire together should train together.

OCD's role would be to furnish training materials. They could be developed from advanced nuclear fire leadership training. Graduates of the national schools would be especially well-prepared to organize and conduct some of the local training.

Fire Research Seminar

Fire research seminars would update leaders of the fire defense program on the evolving research findings pertinent to nuclear fire. Sponsored by OCD and held periodically within OEP-OCD regions, they would bring together representatives of organizations doing fire research and leaders of the operational fire programs. A two-way flow of information would strike at the heart of the problem of implementing research findings: research findings would flow to fire leaders and needs for research would be transmitted back to researchers.

Although the seminars would be sponsored by the Office of Civil Defense, arrangements could be made for a fire educational organization to arrange and conduct many of the seminars.

Basic Nuclear Fire Defense Training

Basic nuclear fire defense training would give supervisory firemen or other fire leaders the basic information required to understand the severity and complexity of nuclear fire; it would relate the nuclear fire problem to the fire control problems typically experienced in peacetime. Except for training in how to use citizens effectively, fire control methods and tactics are not included because the trainees would already be qualified firemen. Though intended for qualified firemen, the training will be valuable to others who have need to understand the basic problems of defense from nuclear fires. While subjects common to the needs of both urban and rural supervisory firemen would be covered, preparation of detailed lesson plans might reveal subject areas where rural and urban options are needed. There are many advantages in training urban and rural fire people together, at least for part of the time. Approximately one week's training is contemplated.

Basic nuclear fire defense training would be presented at the local level, usually as part of the fire service's regular training program. It would also be given to military personnel who might support civil government in defense from nuclear fire. OCD's role would be to prepare training materials and make them available to state and local governments, the fire services, fire supporting organizations, the military and fire educational organizations as needed. When preparing the materials, Part A of work done by Oklahoma State University under Project OCD-OS-63-135 should be used insofar as possible.

Fallout Shelter Inspection and Rating Training

Fallout shelter inspection and rating training would prepare firemen, CD officials and others who inspect fallout shelters to extend their inspections to include fire vulnerability. Shelter fire inspection methods and standards would be presented covering hazards inside and outside the shelter, and a range of protective measures would be prepared for consideration. Armed with this knowledge, the trainees would be prepared to carry out the shelter fire inspection and rating program explained on page 85.

Using materials prepared by OCD, local fire services and CD staff, or perhaps fire educational institutions, could conduct the training.

Shelter Fire Defense Training

Shelter fire defense training would prepare one or more fire guards to supervise the fire defense of each shelter. Although it is desirable to train shelter fire guards in advance of an emergency, no one can be sure that a trained guard or an experienced fireman will be in each shelter at the time of an attack. When previously trained fire personnel are not in the shelter, fire guards must be selected by the shelter manager from the best qualified occupants. Materials for training shelter fire guards should therefore be developed for two purposes:

1. To train guards in advance of an emergency and give them good depth in the knowledge and skills of defending shelters from fire.

2. To provide shelter managers with a kit of instructions to indoctrinate guards who must be selected on the spot.

Training materials for both purposes should include subject matter and instructions applicable for defending all shelters and provisions for inserting specific instructions for each shelter.

Training shelter fire guards in advance of an emergency should usually be performed in connection with other fire training, specifically as a part of regular fireman training, during rural or urban support fireman training (explained later), or during the training of industrial brigades. OCD should prepare and distribute the training materials.

Householder Self-Help Training

After receiving self-help training, householders would know how to reduce the fire vulnerability of their homes, by correcting fire hazards in or near their homes, employing protective measures when warned of attack, and suppressing small fires caused by thermal flash or blast. The training need not have technical depth, but householders would learn enough nuclear fire fundamentals to understand why they must take protective actions. They would learn how to suppress small fires with extinguishers, hand tools, or improvised methods. Furthermore, the training should inform them that, during an attack, they might not enjoy the efficient protection by fire departments that is common in peacetime; indeed, they should be taught that their self-help fire actions would be necessary if fire departments were to successfully deal with the overall nuclear fire threat.

A public prepared through this training would be more receptive to instructions transmitted via TV, radio and other means when an attack appears imminent.

The vehicle recommended for launching the training is a kit prepared by OCD for use by local fire or CD officials in training the householders. Each kit would contain lesson plans, student guides, coaching guides, and training aids.

Urban Fire Defense Support Fireman Training

Urban fire defense support firemen training, building on the householder self-help training, would develop a nucleus of citizens in urban areas who would lead small groups of people to suppress small fires stemming from nuclear attack. Trainees would assist professional firemen as needed and help defend community shelters from fire. The most effective role of these support firemen would be to control, or assist in controlling the spread of fires at or near their shelters, or in their neighborhoods. Accordingly, trainees should be selected so that they will be geographically distributed throughout the urban area. Leadership ability is also an important consideration in selecting trainees. Approximately 40 hours of training is contemplated.

Using materials supplied by OCD, this training would usually be conducted by local fire departments. When developing the training materials, OCD should make all possible use of the materials prepared by Oklahoma State University under Part B of Project Order OCD-OS-63-135.

Rural Fire Defense Training

Rural fire defense training, already in the test stage in five states, provides for rural areas a counterpart of the urban fire defense support fireman. Rural residents who are physically able and interested in rural fire defense, would be trained to: work as effective team members in a firefighting crew; use radiological monitoring information for personal protection; direct measures for public safety in shelters; operate fire control equipment commonly used in their localities and adjacent areas; and participate in rescue and evacuation operations.

Beyond this, special options are offered to persons with strong interests in such specialties as radiological monitoring, rescue, shelter management, shelter fire inspection and rating, nuclear fire analysis of rural areas and other options shown in Appendix D.

Although the training is primarily intended to reduce the wartime fire threat in rural areas, trainees can help prevent and control fires in otherwise unprotected rural areas in peacetime. Indeed, peacetime fires provide an opportunity to sharpen the skills so urgently needed in wartime.

During the pilot programs now underway, training is conducted at the local level by instructors trained by state fire experts with national assistance. This practice seems to work well. Training materials developed and experience gained in these pilot programs, - in the states of Colorado, Oregon, Kentucky, Florida, and Missouri - will be invaluable in extending training to other states.

By working cooperatively with the Forest Service, OCD has already done much to help launch the program. Since rural fire defense is the responsibility of the Department of Agriculture, it follows that when the pilot stage is completed, Agriculture should support the states in carrying out the training. Until this training is recognized in Agriculture appropriations, the alternative is for OCD to help finance the program.

Launching Fire Defense Training

Except for Nuclear Fire Leadership Training and the Fire Research Seminars, OCD's role in fire defense training would be to prepare training materials, sponsor pilot programs to test the materials, and serve as a catalyst to launch the programs throughout the nation.

No organization - including OCD - known to the authors has the in-house capability to develop training materials for the full training program. It is a complex and difficult training venture which imparts an entire new body of knowledge and includes training in conventional skills as well. Thus, a combination of work by training systems experts, fire services, fire supporting organizations, and fire educational organizations is needed to prepare the systems, materials and aids necessary to launch the training program.

There are several ways in which OCD can bring together the required training capabilities. One obvious alternative is for OCD's staff to provide the central core for the program and contract the preparation of materials for each training course. Another would be for OCD to contract the preparation of materials for the entire program to a single firm, which would coordinate the work of subcontractors skilled in specific phases. The authors favor the former alternative but the latter would impose fewer demands on OCD's staff, a point which might merit serious consideration. Regardless of the alternative used, there are important steps that OCD or their contractors should

follow. First, the training program is so interrelated that no part of it should be presented without full knowledge of its relationship to the other training courses. Consequently, development of the program, including control of the contractors, should be supervised by someone who understands it thoroughly. Secondly, a systems analysis and training systems design should precede the development of methods, materials or equipment for any training course. In this way, the most effective combination of components will be identified before development work begins.

Pilot testing of the training programs can be performed either by the contractors, by OCD, or by arrangements with fire services, fire supporting organizations, fire educational organizations or states. It is likely that a combination of these means will prove most effective; pilot programs for individual courses can be arranged with the organization best qualified to test them. OCD would supervise the pilot studies, directly or indirectly, thereby insuring that the objectives set forth in the training guides are met. (Training guides are Appendix D) Testing should be completed and all training materials ready for application throughout the nation by the eighteenth month of the program development schedule.

Meanwhile, the Fire Defense Training Handbook would be prepared and established as an annex in the Federal Civil Defense Guide. This handbook would include diagrams and descriptions of the systems[1] for conducting the training described in each training guide. It would summarize the most effective combination of instructional materials, methods and devices for each system.

By using the training guides in the draft of the Fire Defense Training Program (Appendix D), the Fire Defense Training Handbook can be developed by contract. But to coordinate the handbook with other parts of the program its development should be closely supervised by OCD. Since the training systems

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[1] As discussed here, a training system is the entire process of imparting the desired core of knowledge to the trainee from the beginning of the training course to an effective performance.

included in this handbook must be designed before fire defense materials are prepared, it would be convenient to have the same contractors prepare the training materials and the handbook as well.

After the training materials are tested the program would begin nationwide. To develop the understanding of nuclear fire required for leadership in the program, the basic nuclear fire defense training materials would be distributed to national organizations, concerned Federal agencies and - through the states - to fire services and fire educational organizations. This body of knowledge would be fully integrated into current fire training as soon as possible.

Meanwhile, to develop capability to inspect and rate the fire vulnerability of shelters, the training of the needed inspectors would be in progress in all states by the twenty-fourth month of the program development schedule. At the same time shelter fire guard training would be integrated with pertinent fire training; new fire guards would be trained as necessary, and fire guard training kits would be stocked in all community shelters.

Advanced nuclear fire leadership training would begin early in the program development schedule. Arranged and sponsored by OCD, it would provide informed leadership to all aspects of the fire defense program and would encourage and furnish materials for local nuclear fire leadership training. Moreover, these trained leaders would be prepared to help with other parts of the Civil Defense program as it is advanced.

Householder self-help fire training would be updated in existing CD courses; by the third year of the program a substantial start would be made in training urban fire defense support firemen. Meanwhile, rural fire defense training would be expanded to 19 states by the second year of the program and to 25 states by the third year, thereby rounding out the citizens' training program.

OCD would need to work closely with representatives of the fire services as their program of fire defense progresses. Moreover, since some of the subject matter is new, a shortage of qualified instructors might develop. If it does, OCD could sponsor instructor training as necessary to relieve the shortage.

Evaluating the Training and Updating the Program

Because the results cannot be seen fully unless an attack occurs, it will be difficult to evaluate accurately the results of fire defense training. One way is to test the response of citizens and public officials through exercises. This could be done as part of the regular local or nationwide civil defense exercises. Another way is to test disaster leadership abilities by simulating nuclear attack. Either the simulator equipment developed jointly by OCD and the Forest Service (60) or the simulation techniques developed by Bio-Dynamics, Inc., (43) could be used. OCD's training staff could develop tests requiring responses to varying situations by previously trained personnel. Finally and perhaps most important of all, every opportunity to engage trained personnel in unusual peacetime emergencies could be exploited, and their performance and reactions observed.

Since OCD would develop the training materials, they should also revise and update them as needed. This requires feedback of information about needed improvements to a central national point. This central point could be in OCD or an agency or organization designated by OCD. OCD would establish nationwide procedures to assure that the necessary information flows to the designated central point and that fire defense training materials are always current.

CITIZENS FIRE DEFENSE ACTION

In peacetime as in wartime, action by the citizens is important in preventing and controlling fires. Although usually launched by the fire services, programs such as clean-up campaigns, home fire prevention, plans for escape from fire, and extinguishing small fires depend on the citizens to take final action. Sometimes in rural areas citizens are relied upon by the fire services to detect and report fires, and attack them as well.

Because nuclear attack would restrict the effectiveness of fire equipment and at the same time start numerous fires, the citizen's role would be similar to their peacetime role but magnified many times in importance (64). To shoulder their responsibilities for fire defense, all citizens must be informed in what to do, and a few of them must be trained in how to do it. Past studies and experience show that although qualified citizens can help in controlling some fires, untrained citizens can at times do more harm than good (28).

Whether the public is a help or a hindrance to fire control is determined by its understanding of the problem and its ability to cope with it.

TV and Radio Information Kit for Instructing Householders

When implemented, the training programs for the public, described earlier, would provide enough skills and understanding for citizens to make a significant contribution to fire defense. In addition, a method is needed to give householders specific instructions at the time attack threatens. TV and radio kits are recommended and included in the fire defense program for this purpose.

These kits would contain film strips, recordings and instructions to householders. When completed, the kits would be made available to national TV and radio outlets, fire services and CD officials for use in telling the public what to do during the periods of extreme international tensions or actual attack. Each kit would include generally applicable fire defense instructions plus suggestions on how each community can add necessary local instructions (64).

Fireman-Citizen Teamwork

Combined with citizen training, the TV and radio kits would be OCD's tools for preparing the public to participate in nuclear fire defense. Since the fire services would do most of the citizen training, it is important that the firemen understand, accept and promote citizen participation in nuclear fire activities.

After the programs are in force, householders would be able to correct fire hazards in or near their homes, implement special protective measures when warned of attack, and suppress small fires before taking shelter from fallout. A few citizens, hopefully one or more in each block, would be able to supervise a small crew of neighbors to attack fires in an organized way, aid firemen when necessary, or help defend fallout shelters from fire. Finally, the TV and radio information kits would alert the citizens and refresh their knowledge at the time an attack threatened.

OCD's first step in preparing the public for fire defense action would be to prepare the TV and radio instruction kits. Since several fire educational organizations, fire supporting organizations and private contractors are qualified to prepare the kits, the work could be done under contract with OCD supplying the key points to be included in the narrative.

Meanwhile, the citizens' training, explained earlier, could be developed and the programs advanced as shown in the program development schedule, Appendix E. From the beginning, all fire defense leadership and supervisory training would make clear to the firemen the importance and necessity for citizens actively to prevent and suppress fires. If an attack should occur, fireman-citizen teamwork is the goal.

NUCLEAR FIRE ANALYSIS SYSTEM

Many times during the National Fire Coordination Study the need was demonstrated to tailor the nationwide fire defense program closely to local problems and capabilities. While studying a fire in Bayonne, New Jersey, our analyst described the city this way: "Both residential and commercial areas are congested ... There is a scarcity of open areas ... which might serve as fire breaks ... Most of the buildings are quite old and are generally of wood construction." (31) Of a section of Los Angeles our analyst said: "throughout most of the city the pattern of building is fairly wide streets, wide spacing between structures, and low building heights ... By far the largest portion of the city ... has rather moderate potential for conflagration." (93)

The vulnerability to fire of these two cities obviously differs a great deal. Moreover, their organizations and programs to prevent and control fires in peacetime probably differ. These examples are compounded many times in both rural and urban areas. Although the very heart of the proposed fire defense program is its nationwide measures, the program cannot be fully successful unless these measures are closely adapted to each locality. The Nuclear Fire Analysis System provides a means of adaptation.

The Nuclear Fire Analysis would be an examination of the nuclear fire threat to each community, an inventory of each community's capability to cope with the threat, and an evaluation of the effectiveness of alternative protection measures. Some local data resulting from the analyses, plus additional data developed nationally and programmed in OCD computers, would form the basis for community and nationwide fire defense planning and damage assessment.

The results of each Nuclear Fire Analysis would determine the number and type of fire protection measures the program should undertake for a given locality. For example, the Nuclear Fire Analysis would identify areas where shelters might have to be evacuated quickly if exposed to fire threat; such evacuation would

affect plans for operations during an emergency. Prevailing weather patterns might be identified, revealing from a fire standpoint the times of year when nuclear attack would be the most or least effective; this information might influence the timing of fire prevention campaigns. The possibility of receiving a nuclear strike could be analyzed and the results would influence the application of protective measures.

Firemen-citizen teamwork is the goal. U. S. Forest Service Photo.

Although fire defense programs and preparations differ between communities, the procedures for making each Nuclear Fire Analysis should be uniform. This uniform national system would be carefully coordinated with existing damage assessment systems, and would include:

1. Methods and instructions for collecting information describing the area.

2. Provisions for OCD to furnish attack assumptions.

3. Methods and instructions for using the information to predict attack effects on the area and to assess the effectiveness of the fire defense measures.

4. Provisions for programming key aspects of the system on computers.

Because it would provide a means of identifying the most effective measures to be used in each locality, the Nuclear Fire Analysis System could substantially reduce fire defense costs for state and local governments. Moreover, its use would lessen the danger of certain communities using protective measures which are largely unnecessary.

The Nuclear Fire Analysis System, including instructions for its operation, should be designed and supervised by OCD. In this way it can be thoroughly integrated with analysis and assessment systems serving other national defense activities. An essential first step would be to develop a detailed design for the nationwide system, national to local. The draft of Appendix 1 to Part E, Chapter 10, Federal Civil Defense Guide provides guidance (Appendix B).

OCD could design the system directly through a contractor. When the design is finished, work would begin on each component of the system as shown in the program development schedule, Appendix E. By the sixteenth month, the system would be established as Appendix 1 to Part E, Chapter 10, Federal Civil Defense Guide. Later, each major component of the system would be established as an annex. These major components are described below.

Nuclear Fire Analysis Handbook

As Annex 1 of the system, this handbook would contain detailed procedures and methods for use by local governments and their fire services to conduct Nuclear Fire Analysis for their political jurisdictions or protective districts. It would bring together all of the procedural data needed at the local level, including procedures for: recording and analyzing information describing their areas; estimating the potential nuclear fire threat to their communities; evaluating the relative effectiveness of protective measures available to local units, and using the results of nuclear fire analyses as a basis for fire defense plans. It would also contain samples of nuclear fire analyses prepared for a target city, a non-target city, and a combined rural-small town target city. To provide nationwide coordination, the entire system should be visualized from

local to national levels before the handbook is written. Instructions and subsequent local actions then would permit operation of a centralized data-bank later on.

OCD could develop the handbook by providing guidance to a qualified contractor. Since the handbook would describe the relation between local and national endeavors, its development must be closely correlated with related OCD activities.

Because the Nuclear Fire Analysis Handbook is to be used locally, it is important to reduce the potentially complex analysis procedures to essentials usable by others besides trained problem analysts. Desirable developmental steps are to:

1. Design the necessary methods.

2. Test these methods by conducting analysis in three communities representing different fire defense problems.

3. Revise the methods as necessary.

4. Prepare the handbook.

5. Use pertinent parts of the test analyses as samples in the handbook.

To be most useful, the Nuclear Fire Analysis Handbook should be prepared by the end of the twentieth month in the program development schedule (Appendix G).

Reporting for Data Bank Storage

This annex would contain the forms and instructions for reporting to the national or other data banks, thereby assuring that the data assembled is comparable and usable. It would be used in conjunction with the Nuclear Fire Analysis Handbook. As with the handbook, it would be prepared early in the development of the Nuclear Fire Analysis System. Delay will encourage local units to report data in various ways, to report irrelevant data, or to report no data at all. Once established, local customs might be difficult to change and the opportunity to gather usable data for planning and operational purposes might be lost.

The annex could be developed by a contractor, but the forms and instructions must coincide with other OCD computer-based operations; this suggests to the authors that an in-house approach is best.

Protective Measures

The fire defense program recommended in this report includes several measures for protecting communities from fire. But the capabilities of individual measures and conditions under which they can be effectively used is not generally known to fire service, civil defense or other key personnel. To assess the relative effectiveness of these measures and decide which measure or combination of measures is most useful in their communities, local planners need descriptive information at hand. This information would be furnished as Annex 3, to the Nuclear Fire Analysis System. It would describe measures recommended for use under varying conditions and explain how to use them.

Chapter VI of this report provides information useful for preparing the protective measures annex. This work could be done by contract. The annex should be finished by the end of the twenty-fourth month of the program development schedule (Appendix G).

Urban Fuel Evaluation Guide

A serious drawback to fire defense planning is the lack of adequate information about the ignition and spread characteristics of urban fuels. To provide a sound basis for urban fire defense plans, a guide is needed for evaluating fuels in urban areas. The guide should be usable by operating firemen. In addition to providing basic information for local fire defense planning, the guide would make uniform evaluation of urban fuels throughout the nation, thereby supplying improved data for fire spread models.

Concurrent with the National Fire Coordination Study, Gage Babcock Associates, Inc. have developed a system for assessing the relative conflagration potential of urban areas. After field testing in a community, this work could be used by OCD to prepare the Urban Fuel Classification Guide. If the tests are favorable, the work could be supplemented by other pertinent findings, and samples could be included in Annex 4.

A guide is needed to evaluate fuels in urban areas. American Aerial Surveys Inc. Photo.

Contracting the entire job appears to be the most feasible way to prepare the Guide. It should be ready for distribution by the end of the twenty-eighth month in the program development schedule (Appendix G).

Rural Fuel Evaluation Guide

Information could be gathered as necessary, meanwhile, to prepare rural fuel evaluation guides. Although land cover types in the United States are extensively mapped, there is no uniform system for evaluating fuels in rural areas. In the past, some forest protection agencies have developed guides showing rates of spread and resistance to control for several combinations of grass, brush and timber cover. None of these guides deal fully with the effects of topography and weather on fuel ratings, however, and all are applicable only to local regions. The Forest Service, for instance, has separate fuel classification guides for each of its ten regions. Little information is available about the effects of cropland, pastureland and related farmland fuels on the spread and control of fires.

There is no nationwide system for evaluating fuels in rural areas. U. S. Forest Service Photo.

A comprehensive evaluation of rural fuels in the United States would help define the relative severity of fire problems. Areas of special hazard could be identified and treated accordingly. Dependable estimates could be made of damage or potential damage to important resources by fire. The results would benefit peacetime fire control activities and fire defense operations as well.

The guide should be capable of describing the fuels on the ground in terms useful to the fire defense planner and director of emergency operations. It would contain instructions on how to relate fuels to local variables of weather and topography, and thereby estimate the potential spread of fires. Such a guide would be usable by local and state governments and would also provide a basis for determining the relative severity of potential national fire problems. It would deal with the important fuel factors but retain sufficient simplicity for use in national emergencies.

Since the guide will be used to help estimate damage to resources after uncontrolled fire has burned over an area, it should show probable damage to important resources as a result of fire spreading in various fuels under varying burning conditions.

When available, the fuel evaluation guide would make it possible to map rural fuels in a uniform way throughout the United States. Its subsequent use with the present nationwide system for rating fire danger would permit current comprehensive assessments of fire hazards in areas covered by rural fuels.

Preparing a national evaluation system for rural fuels requires research. The system must be capable of evaluating the whole range of rural fuels from grass and farm crops to complex timber types. After the system is tested and adjusted as needed, the necessary evaluating and mapping can begin.

Current research in the Forest Service is directed towards a uniform national system; monitoring this research will help OCD obtain the guide. Since the Forest Service work is aimed at peacetime fire needs, OCD may want to sponsor research to adapt the guides to fire defense problems. It might be necessary to prepare an interim guide in order to meet the time requirements of the Fire Defense Program. (See the program development schedule, Appendix G)

Analytical Help for Communities

When the Nuclear Fire Analysis System is operating, with basic data reported and programmed on OCD's computers, a method similar to "turn around"[1] but incorporating more analytical capability could be used by OCD to help communities analyze their problems.

FIRE DEFENSE PLANS

At 2:02 p.m. on September 22, 1964, a local resident discovered a small fire near Santa Barbara, California and immediately reported it to the Montecito Fire Station No. 1. This action began a

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[1] A term applied to OCD Form 744-A because data received from localities is entered into an OCD computer, then is "turned around" by automatically printing the data on a new form, which is returned to the originating locality.

chain of events which saw 67,000 acres of land burned over, 226 persons injured, $22 million worth of property destroyed or damaged, and city of Santa Barbara threatened (89).

After the initial attack failed, the fire services and cooperators from throughout the State joined together to control this destructive fire. However, the costs were great - $2.7 million for control alone; it would have been better to have modified the fuel load and spacing to prohibit the fire's development into a monster. The fire started, as have many others, despite determined prevention efforts by fire services, local industry and citizens.

Then began a chain of events which saw 67,000 acres of land burned over.--Santa Barbara News Press

As in the case of the Coyote Fire, the most effective peacetime pre-emergency plans include both preventive measures and strong operational arrangements to be used if prevention fails. Fire defense plans for wartime similarly require both, but because blast damage and radioactive fallout might hamper fire suppression operations, extraordinary emphasis is placed on prevention.

Peacetime Plans Are the Foundation

Although present state and local fire plans have their shortcomings, most of them provide sound guidance for coping with typical fire disasters. From the standpoint of nuclear fire, the principal weaknesses in existing plans are: insufficient emphasis on preventive measures; inadequate description of the potential problem from nuclear fire; incomplete inventories of available manpower and equipment; excessive complications, and no special provisions for protection of fallout shelters during a nuclear attack (62). See Table 6. The mutual aid and command studies and large fire studies, moreover, show that when a disaster occurs, the most effective fire services are those that do the best job of pre-emergency planning.

As a part of redeeming its responsibilities for Rural Fire Defense, the Forest Service has encouraged states to prepare rural fire defense plans. All but five states now have these plans. Rural fire defense committees are presently organized in 49 states. The New England Compact is a noteworthy example of arrangements for interstate aid. Such plans are invaluable in peacetime and each would contribute strength to Fire Defense in wartime, but to be most useful they must be united by a coordinated national plan.

A New National Plan

Since March 1960, the OCDM National Fire Defense Plan (Annex 21) has provided broad policy guidance for fire defense programs. Because its procedures and instructions do not guide state and local units in a specific way, it has been combined with the findings of the NFCS, and a new National Fire Defense Plan has been prepared. The new plan is presented for OCD's use in Appendix C.

The proposed National Fire Defense Plan provides means to coordinate readiness and operational fire defense actions on a national scale; provides fire defense planning objectives for all levels of government; relies on independent local action but provides fire defense coordinators for readiness and emergency operations; identifies the fire staff for emergency operating centers; clarifies the authority and responsibilities for fire defense; describes the fire defense organizations needed at each level of government, and provides specifically for coordination of readiness activities and emergency operations at the National Headquarters. Although management and emergency operations are

Table 6

SUMMARY OF FINDINGS OF MUTUAL AID AND COMMAND STUDIES

ELEMENTS	Portland, Ore. and Vicinity	Michigan	Massachusetts	Wash., D.C. Metropolitan Area	Los Angeles County
Pre-emergency plans					
are prepared by	Fire Serv.	C. D.	Fire Serv.	C. D.	Fire Serv.
are approved by local government	Not yet	No	Yes	Some	Yes
are approved by fire service	Not yet	No	Yes	Some	Yes
are for severe emergency	Yes	Some	Some	Some	Some
defines levels of emergency	No	No	No	No	No
contains activation "trigger"	No	Declared emergency	No	No	Chief's judgment
names the commander	No	Yes	No	No	Yes
names the staff	No	Yes	No	No	Yes
includes job descriptions	No	No	No	No	Yes incomplete
includes priority guides	No	No	No	A few	No
includes fuel classification	No	No	No	No	No
includes shelter protection	No	-	No	No	No
includes pre-selected assignments	No	No	No	No	No
includes forest fire services	Yes	Partial	Partial	Partial	Partial
clearly define the authority and responsibility of all participants	No	No	No	No	No
vary widely within the area	Not in the proposed plan	No-State	Yes	Yes	No

included in the same plan, the instructions for each are separate to avoid confusion.

With the national plan as a guide, regional, state, and local fire defense plans would be prepared or updated, so that they are compatible with one another. It is desirable to integrate fire defense plans with peacetime plans; indeed, separate plans are unnecessary. What is needed is another level of readiness and emergency operations to handle the extraordinary demands of nuclear fire.

Management portions of the plans could be as detailed as the regional, state or local unit deems necessary, but the operational part of the plans must be kept simple and include only the information and guidance needed during an attack. The best plans provide for an annual review of the operational portion by the participants. All local plans should include provisions for protecting each fallout shelter from fire - by organized fire service action, or by the occupants in case fire services are not available.

Implementing Nationwide Planning

Because it is the national organization with across-agency authority in civil defense, OCD would be the catalyst to launch the National Fire Defense Plan. As written, the plan includes a fire coordinator at OCD's National Headquarters and the Regional offices. Additional organizational and committee arrangements at the National Headquarters are proposed which affect OCD, the Forest Service, and other participating organizations (Appendix C). Decisions must be made on these arrangements before the plan is distributed to the field.

Sample Fire Defense Plans

More specific guidance will be provided to fire defense planners throughout the country by development and distribution of plans for representative areas. OCD could contract for preparation of these sample plans and make them available as Annex 1 to the National Fire Defense Plan. Because they are operational in nature, it seems preferable to contract with the fire service or fire supporting organization. There should be a sample plan for each level of government, but priority should be given to samples for cities and counties; each sample should include plans for individual community shelters. These local samples would be based on an actual Nuclear Fire Analysis. The communities used for

sample Nuclear Fire Analysis, described earlier, could also become models for sample fire defense plans.

During the course of this study we observed several elaborate plans, mostly unused. This dilemma was sometimes posed as a reason for not planning for fire defense. Successful emergency fire operations in nuclear attack are contingent upon a high degree of planning, although it should be emphasized that simplified plans are the most effective under emergency conditions. The sample plans prepared for this annex should demonstrate the effectiveness of simplicity. With much of the overall data shown in the National Fire Defense Plan, it should be possible to prepare less complicated plans for other levels of government.

Additional guidance of value in preparing these samples, including an appraisal of the adequacy of existing plans, is available in Chapter VI of the Phase One Report. Preparation or updating of state and local plans could be accelerated if OCD includes this work in their cost-sharing program.

Completing the Nationwide Plan

With guidance in the hands of state and local units through the National Fire Defense Plan and Annex 1, OCD could round out national planning by preparing plans for a fire damage assessment system, a national fire intelligence system, and a national fire communications system. These plans would be published as Annexes 2, 3, and 4 to the National Fire Defense Plan. Preparation of these annexes are described beginning on page 76.

These systems are only a means to an end, however, until personnel are assigned and trained, and equipment established, they are without capability. Through cost-sharing pilot studies and training, OCD can assist in achieving full operational capability.

SUPPORT ACTIVITIES

The support activities included in the Fire Defense Program are: preparation of guidelines for community planning to minimize fire spread; infrared mapping of nuclear fires; a nationwide fire intelligence system; a nationwide fire communications system; and a fire damage assessment system. These systems would strengthen peacetime fire control and are the major support systems required to reduce the threat from nuclear fire as well.

Guides for Community Planning to Minimize Fire Spread

Existing fire codes are believed to be effective in stimulating the design of structures which minimize fire vulnerability, but local planners need guides that deal with reducing the probability of fires which spread from building to building. Urban renewal projects are making fire spread less likely in many communities. The guides proposed here would inject positive consideration for fire spread into urban renewal activities by describing the nuclear fire threat to communities and prescribing how to incorporate planning measures to lessen the threat. Reflecting OCD's nationwide policy, the guides would help architects and community planners consider the fire spread problem.

Ongoing, urban renewal projects are making firespread less likely in communities today. U. S. Forest Service photo.

Although they are of some immediate value, the results of these guides would have more influence in future planning; through their use, the fire spread hazard in cities would gradually be lessened. OCD could prepare the guides in handbook form. A section in the

handbook would give a brief summary of urban fire spread knowledge, including the nuclear fire problem. Existing fire guides and codes could be studied to establish a starting point for the handbook.

The handbook could be developed under contract by one of several qualified fire supporting organizations or independent contractors. In addition to OCD research findings and the data in this report, a wealth of information is available from the American Insurance Association and the National Fire Protection Association.

Because they offer few immediate benefits, guides for community planning are not given first priority in the program development schedule. Because the concepts in them are so fundamental to reflecting a national policy for fire safe community development, however, it will indeed be unfortunate if they are not prepared.

Nationwide Fire Intelligence System

Present methods and organization for obtaining strategic and tactical intelligence information are severely taxed - and are sometimes inadequate - for conflagrations experienced in peacetime. Unlike fires that would accompany a nuclear attack, these peacetime disasters usually occur singly; if they occur in multiples, they are usually confined to a single zone such as one or two states.

A nationally coordinated fire intelligence system is needed to prepare for the strategic and tactical decisions required by a nuclear attack (64). When fully developed, the system would provide means to: map fires in sufficient detail to meet the needs of tactical fire control managers; furnish these maps at specified time intervals; map the size and location of fires across the United States for overall strategic purposes, and predict the spread of fires by 12-hour periods. The design of the system, included in the proposed fire defense program, would identify the combination of components required to gather the intelligence and describe how to use them.

Closely related to the fire intelligence system is the Nuclear Fire Analysis System discussed on page 62. This system inventories and analyzes fire data for planning purposes prior to an attack. The intelligence system would gather and analyze pertinent fire data during and following an attack.

It would be advantageous to consider the combined output of both systems in making tactical or strategic fire problem analysis and subsequent decisions. During an attack, the two systems could be combined at the National Headquarters with attack information from NUDETS (Nuclear Detonation Reporting System) to estimate the fire situation throughout the United States.

Designing the Nationwide Fire Intelligence System is the next task for OCD to undertake; its need was established in the Phase One Report. An initial step would be to examine the present plans of the military and other government agencies for gathering intelligence pertinent to nuclear fires. By integrating these plans with the capabilities and practices of state and local governments, planners can design a coordinated system which would permit expansion in much the same way as operations in the National Fire Defense Plan (Appendix C). Indeed, it is only a part of this larger plan, and to be useful during an attack the system must provide intelligence to support strategic and tactical operations as the problem unfolds.

After examining existing capabilities and practices, the best combination of methods, techniques and equipment would be determined. Since infrared mapping shows great promise, it should be carefully considered. Provisions for automating fire intelligence data at the National Headquarters might expedite estimates of the nationwide fire situation.

The design for the fire intelligence system would become Annex 3 to the National Fire Defense Plan. Because the Nationwide Fire Intelligence System would be used by many fire services who already have a system of their own, a good cross-section of these services should participate in designing the system. The plan for the system could be developed under contract; the fire services or fire organizations are well qualified to do the work. Among other capabilities, systems analysis skills are required, but if the selected fire service organization doesn't already have them, it could subcontract for them. OCD would have to provide strong liaison to any contract in order to make the fire intelligence system compatible with other defense support systems. To enhance the development of the whole fire defense program, progress should be as shown in the development schedule (Appendix G).

Infrared Mapping of Nuclear Fires

At the present time, OCD and the U. S. Forest Service are cooperatively developing and using infrared techniques to map large fires. The work shows promise for application to fire defense. The most serious shortcoming is the possible shortage of the proper combination of airplanes, personnel and infrared equipment during and after an attack. An essential part of the intelligence system, described earlier, infrared mapping would be useful for gathering both tactical and strategic fire information (64). The National Fire Coordination Study, however, has dealt principally with tactical use of infrared mapping.

Under conditions of smoke, smog or darkness, infrared mapping presents the most obvious means of gathering fire intelligence short of laborious ground reconnaissance. Consequently, its development for use in civilian fire defense is worthy investment for OCD.

In developing the infrared capability essential for wartime, OCD should:

1. Continue cooperative work with the U. S. Forest Service to perfect methods and equipment to meet the requirements described later.

2. When methods and equipment are satisfactory, develop a pilot program in one state or a group of states.

3. Adapt the lessons learned in the pilot stage, then expand the program until the desired capability is available.

Meanwhile, peacetime operational use of infrared equipment can be expanded by joint efforts of OCD and the Forest Service, thereby making additional trained personnel and infrared equipment available in case an attack occurs.

A recent study made for OCD by HRB Singer, Inc. shows that, within civilian government, the U. S. Forest Service and its state counterparts have the best capability for performing the infrared fire mapping mission. The Civil Air Patrol is the civilian organization capable of handling post-attack fire mapping. Military aerial mapping capability also might be available. The resources of each state should be evaluated separately and the infrared

mapping capability arranged accordingly (57). In some cases it might be better to expand the initial evaluation to a group of states especially where states - such as the New England compact states - are already working together on fire problems.

When infrared mapping is organized on a state or zone basis, capability can be developed concurrently from the resources of the Forest Service, its state counterparts, Federal cooperators, the military, CAP, and other agencies responsible for urban and suburban areas. In this way, OCD could take maximum advantage of the aerial mapping capabilities of rural fire services already in the business. If agreeable to both parties, the Forest Service could materially help OCD with the pilot program and later expansion.

Infrared mapping of rural fires has shown a strong potential for use in urban areas. Through use of an infrared unit, good quality imagery of urban fires and terrain was obtained during the Los Angeles Riot Fires of 1965. In studying these fires, our analyst concluded that infrared mapping shows promise for mapping urban fires in nuclear attack situations (93).

Although requirements for urban areas have not been dealt with, infrared mapping needs for tactical purposes in rural areas were defined. The most important requirement is a sensitive picture of the fire edge tied exactly to ground features. Ridge tops, valley bottoms, streams and prominent points should be discernible in sufficient detail to determine the precise location of fire edge, spot fires, fuel type changes and fuel breaks. In addition, the following degree of detail in infrared imagery is required; it is adequate for fire suppression decision-making when accompanied by maps showing topography fuels, and physical features:

<u>Fire Edge Characteristics</u>

1. The entire fire edge must be discernible, including cold edge, smouldering edge and flaming fronts.

2. Visibility of flames on various sectors must permit estimates of intensity and rates of spread.

3. Hand, dozer and fire retardant lines should be discernible.

4. Size and number of spotfires outside the fire edge should be discernible.

Relationship of Fire Edge to Fuels

1. Snags and hot spots burning within the fire perimeter and within 300 feet of the fire edge should be discernible. It is desirable but not necessary to distinguish between snags and hot spots.

2. Unburned patches of fuel more than five acres in size within the fire should be discernible.

3. Major fuel type changes should be discernible for a distance of one or more miles outside the edge of the fire - specifically, changes between: grass and brush; tall timber and brush; conifer and hardwood; blowdown and standing timber; water and land; rocks and timber; rural and urban.

4. Fuel breaks should be discernible for a distance of one or more miles outside the edge of the fire. Such breaks should include country roads; highways; streams not hidden by forest canopy; prepared fire breaks.

Relationship of Fire Edge to Values Threatened

Structural improvements such as residences, bridges, factories, schools, and urban communities should be discernible.

The above requirements should guide the development of infrared mapping equipment and methods until or unless more demanding requirements are established for cities.

While developing infrared mapping capabilities, OCD should recognize that infrared mapping is useful only if a competent organization is functioning on the ground to receive and use the imagery. The plans and training programs described earlier are intended to assure that ground organizations are capable of interpreting and using the imagery under nuclear-attack conditions. When infrared techniques are to be used, they should be included in the fire defense plans for each community or planning area, and key personnel should be trained to receive and use the infrared imagery.

Fortunately, infrared mapping techniques have current peacetime applications. Within the limits of their finances, fire protection agencies could use these techniques to advantage for detecting and mapping peacetime fires. These users provide OCD with an opportunity, through cooperative financing and effort, to install equipment and train personnel. The infrared units[1] could be used currently by the fire protection agencies, thus maintaining an up-to-date operating capability that could be directed to map nuclear fires if an attack occurs.

Security requirements will have marked effect on implementing infrared mapping. If the system is classified, its expansion would be limited to organizations able to control security. Moreover, the opportunity to have trained "back-up" operators for the equipment will be reduced.

Nationwide Fire Communications System

More than any other support activity, successful fire control depends on communications. Communications takes many forms - high and low band radio, telephone, teletype, telegram, closed circuit TV, air to ground message drops, and radar are some that were observed during the study. Communications preceding and during a large fire are complicated and not always certain. Wartime, with its accompanying blast, fallout and fire damage, would create additional communications problems. What would be needed then is a relatively simple, dependable, uniform national system.

The nationwide communications system would be a close companion to the fire intelligence system described earlier and to the Civil Defense Communication Systems presently in use (NACOM 1 and NACOM 2). The intelligence system is useless unless its output can be communicated swiftly and surely to emergency operating centers where decisions are made. In addition, dependable communications will make possible the high degree of control and direction of the fire forces which would be necessary during an attack (64).

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[1] A unit is one airplane equipped with scanner and printer.

More than any other support activity, successful fire control depends on communications. U. S. Forest Service photo.

The National Fire Coordination Study identified several of the requirements for a nationwide system, but did not examine the relationship of these requirements to existing nationwide communications networks. OCD could do this while developing the fire defense program, thereby deciding the extent to which these networks can serve fire. The first question to be answered is: can the NACOM systems, current or planned, adequately handle fire defense communications, or do we need an independent nationwide fire communications system?

In order to provide adequate communications during a nuclear attack, the communications system should be capable of:

1. Providing positive information between firelines, headquarters, mutual-aid partners, and coordination centers.

2. Coordinating all public services to fully utilize their facilities in a disaster.

3. Providing strategic and tactical communication for each disaster problem area without jamming others.

The plan for the Fire Communications System should be prepared by OCD as Annex 4 to the National Fire Defense Plan. This annex would guide OCD, its Federal cooperators, the fire services and state and local governments in their efforts to achieve the system's full potential.

Drafting of the plan should be preceded by a study to define the scope of the system and relate it to the several communications systems presently in use. The communication system annex could be developed by contracting. As with the intelligence system, there are fire services and fire organizations well qualified to do the job. The annex should be completed by the end of the twenty-fourth month in the program development schedule (Appendix G).

Standard fire services terminology and radio operating procedures would also improve communications. Although desirable immediately, these procedures could be prepared later without seriously imparing the efficiency of the communications system.

Fire Damage Assessment System

OCD's proposed instructions for estimating damage to resources from fire are contained in the book "Estimating Survivors and Resources Remaining After a Nuclear Detonation for Civil Defense Purposes" (Advance copy) dated February 1965. OCD could either integrate fire damage assessment with other damage assessment systems and publish guidance as Annex 2, or expand the fire portion of the current instructions. Regardless of the procedure used, assessing damage from nuclear fire is necessary for making operational decisions and is closely related to the fire intelligence system discussed earlier. Comprehensive guidance materials should be available to damage assessment officers in the event of an attack.

Fire damage assessment output could be used in three ways. First, it could be used in pre-attack planning to assess damage to resources and the threat to lives from hypothetical attacks. Second, during a nuclear attack it would make it possible to estimate the human and material resources remaining in areas burned over by fire. Third, when used with the fuel evaluation guides, it would predict potential damage to resources and threat to lives in areas menaced by spreading fires. Consequently, priorities would be made clear and operational decisions enhanced.

Existing instructions contain guidance for estimating the areas of primary and secondary ignitions following a nuclear detonation, but they are silent regarding the subsequent spread and threat from fires. With fuel evaluation instructions available, the existing fire damage assessment system can be extended to include predictions of fire spread. Then by establishing vulnerability criteria for each resource, including fallout shelters, predictions can be made of potential damage from fire and estimates made of damage after the fire passes through.

From the standpoint of assessing fire damage, existing OCD instructions place undue emphasis on estimating damage at the local level. Estimates are necessary at the national level and to a lesser degree at OCD regions and states. At or near the scenes of emergencies, damage from fire should be determined mostly by on-site observations, with estimates limited to predicting damage from expected fire spread. Sound information can then be reported to higher levels to be used for improving their estimates.

As mentioned above, the fire damage assessment system must be closely related to ongoing procedures in OCD and could, therefore, be developed best by OCD personnel. Completion should be timed with other activities as shown on the Fire Defense Program Development schedule (Appendix E).

SPECIAL PREPARATIONS FOR DEFENDING SHELTERS

In addition to training, plans and support activities described earlier, protective measures to reduce the incidence of fire threat to shelter buildings must be arranged in advance of an attack. The most effective combination of protective measures for a given community would be determined by a Nuclear Fire Analysis, (See page 62.) but specific examination of each shelter building is needed to decide the best measures for community shelters.

Means of protecting shelters from fire include:

1. Shelter Fire Inspection and Vulnerability Rating.

2. Fireproof Roofing for Shelter Buildings.

3. Shelter Fire Suppression Equipment.

4. Auxiliary Water Supplies in Shelters.

5. Shelter Fire Guards.

When completed, Annex 5, Appendix 1, Part E, Chapter 10, of the Federal Civil Defense Guide would contain descriptions and instructions for using these and other measures. The above measures are described in Chapter VI; their implementation is discussed below.

Because it is necessary to know the fire vulnerability before planning the defense of each shelter, OCD's first efforts should be to perform a Shelter Fire Inspection and Vulnerability Rating measure. Both Factory Mutual Research Corporation (85) and Illinois Institute of Technology Research Institute (51) (100) have been working on systems of classifying the fire hazard to shelter occupants and on shelter fire vulnerability. This material could be combined in a shelter fire inspector's handbook with very little effort by OCD. To guide the inspectors when surveying fire hazards outside of shelter buildings, the system for local assessment of conflagration potential developed by Gage-Babcock

Associates, Inc. (17) would have to be similarly treated. Then by launching the training described on page 54, OCD's Shelter Fire Inspection and Vulnerability Rating would be underway.

Among other things, Shelter Fire Inspection and Vulnerability Rating would identify the most effective equipment for defending the shelters by the occupants. OCD could encourage local governments to get the necessary fire defense equipment into the shelters through instructions in their Federal Civil Defense Guide and by sharing the costs of the equipment.

Since auxiliary water in shelters is so important for fire protection, OCD should establish a policy that water be made available in community shelters in target zones unless the fire defense plan for the shelter shows it is not needed. This policy could be reflected in the Civil Defense Guide and procedures to supply the water could be described in the Protective Measures Annex. When it is justified by shelter fire inspections and reflected in the plans for fire defense of the shelter, OCD could share with local governments the cost of supplying static water.

OCD can further help shelter fire defense by requiring assignment of a fire guard in each occupied shelter. This policy could be set forth in the Federal Civil Defense Guide. These guards would be recruited from industrial fire brigades, professional firemen, fire defense support firemen, or rural fire defense firemen. By carrying out the fire guard training described on page 54, OCD could have qualified guards ready in case of attack.

While the protective measures discussed above deal directly with protecting fallout shelter buildings from fire, other measures in the fire defense program would reduce the overall fire threat and thus lessen the danger to each shelter.

In summary, implementing shelter fire protective measures requires:

1. Inspection and subsequent fire vulnerability rating for each community shelter.

2. Determination of the fire equipment and auxiliary water supplies required in the shelter building.

3. A plan for defending the shelter.

4. A qualified fire guard to help the shelter manager carry out the shelter fire plan. These measures would safeguard many lives, but even with all of them operating it would sometimes be prudent to evacuate to a safer shelter instead of defending the shelter threatened by fire.

EMERGENCY OPERATIONS

As described in Chapter III, emergency operations are the final phase of the operational fire defense program; they include fire control and associated rescue performed during and following an attack. These operations would be carried on at the scenes of emergencies, mostly by the fire services and the citizens. For the most part, OCD's contribution would come through the readiness activities previously discussed in this Chapter and through organizational and mutual aid activities to be discussed later.

OCD could further strengthen Emergency Operations in time of attack by:

1. Developing equipment for dispatching and keeping track of fire control personnel and suppression resources.

2. Promoting the use of aerial equipment in nuclear fire suppression and rescue.

Resource Locator Equipment

Equipment and methods presently in use to dispatch, control and retrieve resources during fire emergencies vary from handwritten logs to electronic arrangements for automatic dispatch. During the NFCS, samples of these were examined; they are discussed in Chapter VI, beginning on page 116. Also discussed, is portable resource locator equipment which could be used during nuclear attack at Emergency Operating Centers or improvised command posts. A prototype is presented which gives dependable operation under the adverse conditions of nuclear attack. While eliminating much detailed work, the equipment would help dispatchers maintain resource inventories, follow resources in-transit, and record fire line assignments. During an attack, resource locator equipment would be especially useful at Emergency Operating Centers.

Since the prototype equipment is untested, OCD should arrange to evaluate it under both urban and rural fire conditions. About ten working models should be built for testing. The Forest Service could supervise rural tests, and one of the fire supporting organizations could supervise the urban tests. During field testing, the equipment's usefulness in peacetime operations would be determined.

The number of equipment sets will be determined by the number needed in peacetime, plus those needed for the extraordinary requirements for nuclear attack. OCD could share the costs of the additional sets needed for nuclear attack. Since the equipment can handle many types of resources, OCD may want to test its usefulness in fields other than fire.

Aircraft in Emergency Operations

During the Los Angeles Riot Fires in 1965, a "telecopter" hovering over the fires sent live coverage direct to TV screens in command posts. As a result, fire commanders were usually better informed than the forces on the ground. The "telecopter" technique is one example of how aircraft can contribute to fire emergency operations during and following a nuclear attack.

We have discussed aerial mapping of nuclear fires using infrared techniques. Additional uses of aircraft would include: transporting key personnel and equipment from one part of the country to another; fixed wing or helicopter reconnaissance of fire disaster areas; delivery of fire retardants by aircraft, and use of helicopters in fire suppression and rescue missions. When fallout conditions permit their operation, helicopters would be especially useful to rescue trapped persons, to lay fire hose across rubble, and to deliver special fire defense equipment to fallout shelters threatened by fire (64).

While experience has demonstrated that aerially-applied retardants can protect some structures and reduce fire spread in several types of rural fuels, little is known about the effects of aerially-applied retardants on fires spreading in urban areas. Consequently, we have recommended in Chapter VI such a study.

Since the costs of maintaining air operational capability are so high, the plan should make the most effective use of currently available aircraft and supplement these with extra equipment and trained personnel as needed. This can be done best by the fire services through the planning arrangements already described.

A helicopter hovering over the fire sent live coverage direct to TV screens and command posts.

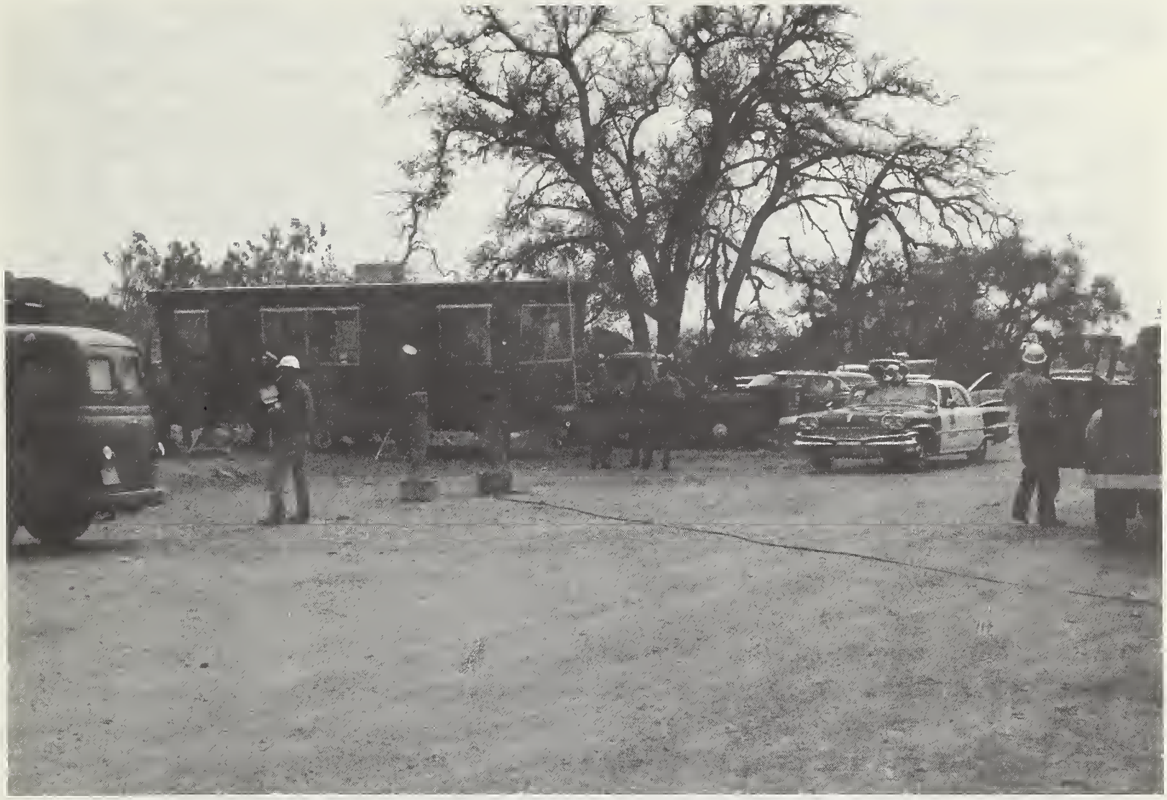
The fire services throughout the United States may be able to use aircraft following a nuclear attack, and OCD can help them achieve and maintain readiness by: encouraging state governors and civil defense directors to inventory their potential aircraft needs and weigh them against aircraft availability; including use of aerial equipment in nuclear fire leadership training, and conducting the urban aerial fire retardant study mentioned above. This guidance would be reflected in the training programs and Federal Civil Defense Guide instructions discussed earlier. Furthermore, it would be appropriate for OCD to share the costs of extraordinary equipment needs for using aircraft for fire defense.

By the spring of 1941, it was decided in England that a fire service composed of many independent commands - about 1600, including Scotland - had reached the limit of its possibilities to protect the country from enemy incendiary attacks. The Home Secretary, Mr. Herbert Morrison, made the bold decision to nationalize the fire services (6). As was demonstrated later, nationalization of the fire service was effective for England; indeed, it was necessary to achieve the unity of command and operational flexibility required to save the country from the ravages of fire. England's experience during World War II has great significance for fire defense of the United States.

In addition to several hundred state, Federal and private fire services, continental U. S. has approximately 22,500 fire departments under independent command. To obtain the unity of command and flexibility of operations necessary to cope with a nuclear attack would be far more difficult here than in England. The authors suggest no element of nationalization for the fire services in this country. On the contrary, the proposed program of fire defense would seek to develop the capability and coordination to make nationalization unnecessary, even though England's experience suggests that the lack of a strong preparatory fire defense program in peacetime might make nationalization the only alternative in wartime. When preparing the nation for fire defense, the organization and staffing discussed in this section is especially significant to unity of command and flexibility of operations.

A Nationwide Organization for Fire Defense

When implementing the fire defense program, it will be necessary to integrate it into current fire and CD activities. To accomplish this, an organization is proposed which has been discussed with representative fire leaders and CD personnel. It is compatible with the overall Civil Defense Organization shown in Part A, Chapter 2, Federal Civil Defense Guide. The proposed organization (Figure 1, Page 14) includes the direction, coordination and cooperation necessary to give the fire defense program unity and flexibility, provided it is established throughout the United States.



Unity of command and flexibility of operations.--Los Angeles County Fire Department.

The Fire Defense Coordinators are a significant part of the proposed nationwide organization. Through these personnel, plus State and National advisory committees, we hope to avoid the need for a nationalized or quasi-nationalized fire service. The duties of these coordinators and committees are described in the National Fire Defense Plan (Appendix C).

The proposed organization would hold the fire defense program together from local to national levels and guide readiness activities and emergency operations during and following an attack. During an attack, OCD's concept of emergency operating centers would come into play. Along with other staffs, fire staffs would assemble at these centers to help bring the weight of all available public services to bear on the disaster. Consequently, a fire staff organizational plan is needed at emergency operating centers.

Fire Organization and Staffing for Emergency Operating Centers

Emergency operations could be required for centers at any of the organizational levels or combinations of levels shown in Figure 1. Operations from a state EOC would be necessary whenever three or four disasters were underway simultaneously within the state. A disaster wholly within a county would place severe demands on the county EOC but fewer requirements on the state EOC. However, even a light nuclear attack would create need for operations at all major emergency centers.

Fire operations at EOC's will vary a great deal but will necessarily be tailored to the requirements of the disaster being dealt with. With the exception of the front line tactical command posts, the same general fire staff complement could serve adequately at any EOC. A primary requirement is staffing the organization so that it can be expanded as necessary to cope with the disaster.

No special organization or staffing is suggested for tactical fire control operations during a nuclear attack, but the fire services would have to be prepared for many complications. As in peacetime, wartime tactical command should rest with the local fire chiefs. From an organizational viewpoint, the potentially overwhelming magnitude of the fire problem is the greatest difference between peacetime and wartime fires. As a result, the organization and staffing recommended for EOC's primarily concerns situations where coordination of several local departments is necessary to control a disaster.

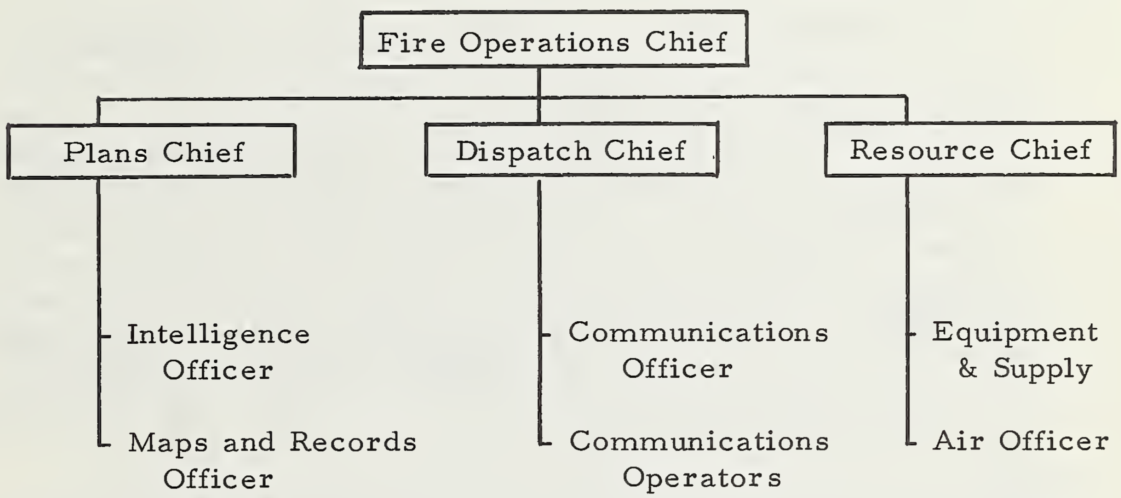
When describing the EOC fire staff for the scenes of a disaster, it is assumed that a manager or operations officer is available and designated in charge of all aspects of the disaster, including fire. The role of the fire staff, then, is to analyze the fire situation, report information to the disaster operations officer, help the manager and his staff weigh priorities and make decisions, and carry out the fire aspects of the decisions after they are made.

Duties of fire staffs at EOC's further removed from the scenes of action would be similar except that their responsibilities would be primarily coordination. During emergencies, the Fire Coordinators shown in Figure 1 and discussed in the National Fire Defense Plan, would serve as the fire staff at the EOC. These coordinators would be outstanding fire officials especially trained for the job.

The optimum fire staff required at each emergency operating center and their organization are shown in Figure 7. Their responsibilities, qualifications and duties are explained in Appendix A.

Figure 7

FULLY DEVELOPED FIRE ORGANIZATION FOR EMERGENCY OPERATING CENTERS



Fire Organization and Staffing for Community Shelters

Shelter fire guards on the shelter managers' staff are proposed to meet fire defense needs of individual shelters (Chapter VI, page 110. Because the organization necessary for defense of individual shelters would vary greatly, no organization plan is presented. However, we propose that a fire defense plan be prepared for each shelter which would form the basis for organizing the shelter's defense.

Establishing Fire Defense Organization and Staffing

Much of the action required of OCD to establish the proposed organization for fire defense has been discussed earlier in this Chapter. The salient steps are:

1. Establishing the necessary fire coordinators in the OCD organization.

2. Making the organization and staffing concepts known by publishing them in Part E, Chapter 10, Federal Civil Defense Guide.

3. Including the fire organization and staffing concepts in a handbook for Emergency Operating Center planning and operations.

4. Making fire organization and staffing concepts a part of appropriate fire defense training.

MUTUAL AID: FROM UNITY COMES STRENGTH

Over the years, firemen have assembled manpower and equipment to fight disastrous fires cooperatively. This "help thy neighbor" creed is commonplace today, as demonstrated by the widespread use of mutual aid by the fire services. Of the 13 large fires examined during the NFCS, 12 involved aid from more than one jurisdiction. On four of these fires, aid was assembled from across state lines. As a rule, mutual aid arrangements - some formal, some informal - are available between communities within the U. S. to meet the demands of fire disasters that these communities have experienced in the past (62).

Recognizing mutual aid as a vital function of the fire defense program, this section seeks to:

1. Briefly describe current mutual aid arrangements.

2. Describe what additional arrangements are needed to meet the nuclear fire threat.

3. Recommend OCD policy or action needed to achieve these needed improvements.

The functions of command, coordination and training are important to mutual aid but are not discussed in depth here. They are treated under organizing and staffing, beginning on page 90.

Current Mutual Aid vs Requirements for Nuclear Fire

Although mutual aid between fire protection forces is common today, there are problems that, if solved, would improve mutual aid for nuclear fire control operations and peacetime fires as well. Pre-emergency arrangements are the key. Most mutual aid

problems include scope, legal authority, payment policy, liability, activation of plans, and responsibility. Even with these problems solved, the critical decision of how much aid to give the neighbor, and how much strength to keep at home, will always be present; it will be especially acute during a nuclear attack.

The most important differences between fire mutual aid requirements in peacetime and wartime are the difference in geographic scope and the constraints imposed by radioactive fallout. Fires stemming from nuclear attack would be more severe and cover larger areas than those experienced in peacetime. Personnel and equipment needed to help local fire forces in beleaguered areas will have to be assembled from a broader geographical area than normal - perhaps from several jurisdictions. Radioactive fallout will sometimes delay the movement of mutual aid forces; nevertheless, it will be advantageous to have mutual aid arrangements covering as broad an area as possible.

Case histories from England's 1940-42 air raid fires demonstrate the inadequacy in wartime of mutual aid arrangements designed for peacetime. H. Bond reports: (7)

> "Although arrangements were made for men and apparatus to come in from outside places to reinforce the local brigades the fire defense arrangements were built around the local fire department and the local fire chief. However, logical as this arrangement appeared, it completely broke down when the heavy raids started ... The stories of Coventry, Southampton ... are monotonous ... Unattended fires, yet numbers of unemployed and fully manned pumps available ... large fires ... without officers in charge, lack of training in water relaying ... lack of organization ... and outstanding lack of leadership in the general direction of operations ... It must be clear to each officer whose directions he should accept ... Where a large number of officers unknown personally to each other are working together, it is necessary to establish this ranking by a uniform system of insignia."

To solve their organization, leadership and mutual aid problems, England nationalized the fire services. As mentioned previously, we do not propose that this be done in the United States. On the contrary, the recommended mutual aid policies would seek to strengthen local fire departments, increase their flexibility to help one another, thereby preventing the breakdown experienced by England when under heavy attack.

Some State Level Mutual Aid Arrangements

Already several states have fire disaster plans which permit statewide exchange of fire forces and equipment such as that needed for nuclear attack. For example, the California State Disaster Plan provides means of arranging mutual aid throughout the state, and upon declaration of a state of extreme emergency by the governor, provides for mobilizing manpower and equipment as necessary.

Oregon's conflagration Act of 1947 and its Civil Defense Act of 1949 provide for the integration and direction of state firefighting forces in the event of an emergency, or threat of emergency beyond the capabilities of one county's fire defense. Likewise, the New York State Fire Operational Plan provides for mutual aid between counties whenever a disaster exceeds the capability of any county.

The states of California, Oregon, New York and others have mutual aid arrangements which strengthen their abilities to cope with nuclear fire. These arrangements can serve as an example for other states faced with the problem of preparing for the nuclear fire threat.

Current OCD Policy

The Federal Civil Defense Act of 1950 includes authorization to assist and encourage the States to negotiate and enter into interstate Civil Defense compacts. However, the President, in Executive Order 10952, assigned this responsibility to the Office of Emergency Planning. Meanwhile, through Sections 2 and 10 of of their model State Civil Defense Act, OCD has encouraged the States to develop mutual aid arrangements within their State and with neighboring States.

Suggested Future Policy and Procedures for OCD

OCD could further help the States prepare for defense against nuclear fire by establishing a mutual aid policy similar to this one:

> In order to advance the defense of the United States from nuclear fire, the OCD mutual aid policy will:

1. Encourage each State to enact legislation permitting the governor to establish free interchange of fire forces within the state when nuclear attack or other fire disasters create a state of emergency; such legislation should also provide coverage for personal injuries and liability for damages.

2. In cooperation with the Office of Emergency Planning, encourage and aid each State to enter into interstate compacts as necessary to prepare for fire defense.

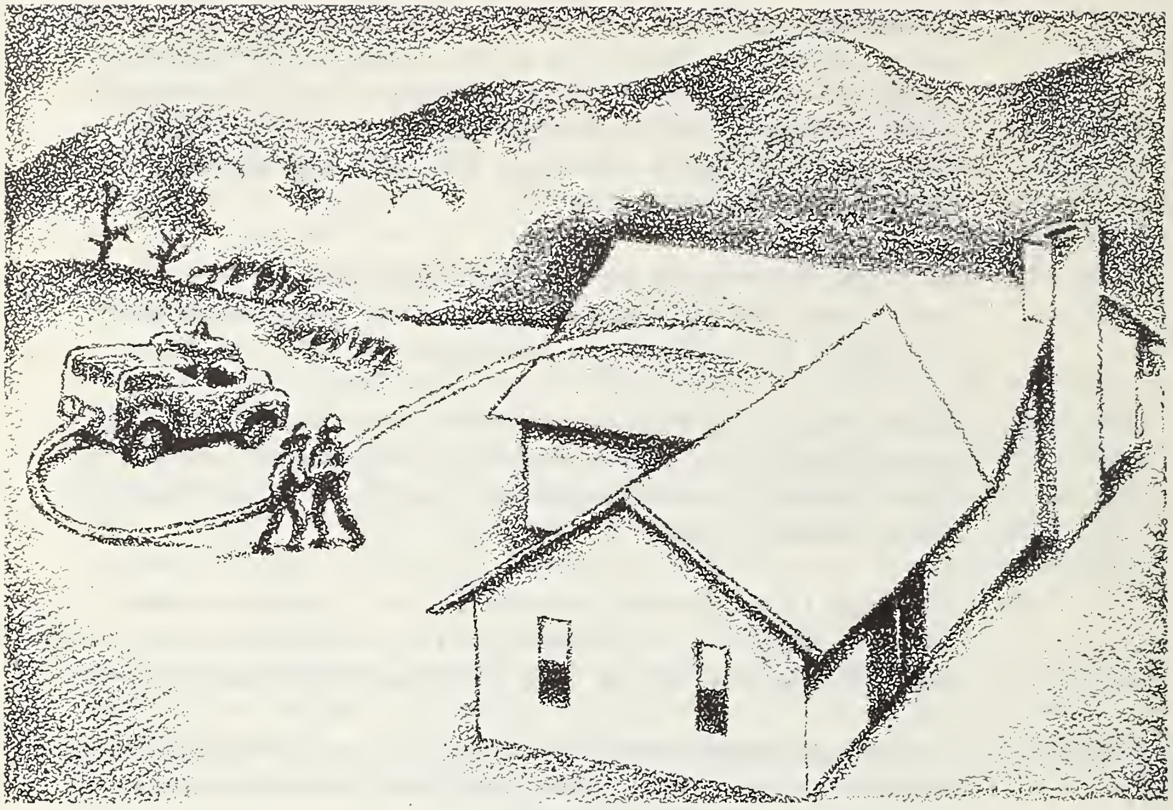
3. Encourage each State to provide for implementing the above legislation and interstate compacts by assigning Fire Defense Coordinators as described in the National Fire Defense Plan.

4. Arrange to implement mutual aid on a regional and national basis by establishing fire coordination capability in OCD regional offices and National Headquarters.

5. Encourage mutual aid arrangements and training between urban fire services, State and local rural fire services, and the Federal fire services.

6. When they qualify under cost-sharing regulations, share with the States the cost of extraordinary mutual aid arrangements for nuclear fire.

The above policy could be disseminated by publishing it in the Federal Civil Defense Guide. OCD could then work with the States and other Federal agencies as necessary to achieve arrangements for the flexible interchange of fire personnel and equipment that would be required if an attack occurs. Meanwhile, the mutual aid policy and the requirements for carrying it out could be further explained by including it in Advanced Nuclear Fire Leadership Training. Also the sample fire defense plans, beginning on page 73 could contain a thorough treatment of mutual aid arrangements.



V RELATING FIRE DEFENSE TO PEACETIME FIRE CONTROL

In September 1964 our analyst said of the Santa Rosa Fires: "When the fire entered Calistoga, the California Division of Forestry, the California Disaster Office and Mutual Aid Units ... fought the fire from house to house along rather narrow, twisting, steep streets amid thick vegetation. Each pumper crew would work on a house until it was saved, or lost, then move on to the next. This action was extremely effective." Of action in the city of Santa Rosa, the analyst said "as in Calistoga, the California Division of Forestry pumpers and Santa Rosa trucks augmented by 40 or more California Disaster Office municipal trucks, fought from house to house." These examples of Civil Defense equipment used in peacetime demonstrate the central idea of this Chapter -- to integrate the Fire Defense Program with peacetime activities as much as possible (91).

Although standby measures and equipment could be justified economically for nuclear fire purposes alone, it would be very difficult to get public acceptance for this practice. Additional reasons for integrating components of the Fire Defense Program with peacetime fire activities are:

Fought the fire from house to house ----- until it was lost or saved.--Los Angeles County Fire Department

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1. Peacetime emergencies provide an opportunity to train, develop techniques, and practice for wartime. There is no substitute for firefighting experience and on-the-job training received on peacetime emergencies such as the Watts Riot Fires in 1965 and the Boston Fires of 1962-63-64.

2. The American public receives current benefits from their wartime readiness investments.

3. When used currently, the measures are more likely to be employed effectively during a serious emergency.

4. Many fire defense measures are only extensions of normal peacetime activities.

5. Some nuclear fire defense measures can fill a peacetime fire protection need which could not otherwise be financed by local governments.

There is no substitute for firefighting experience and on-the-job training. U. S. Forest Service photo.

6. Being dependent on the proven fire services in peacetime, the public will expect them to respond to the nuclear fire threat.

DEFINING PEACETIME VS NUCLEAR FIRE MEASURES

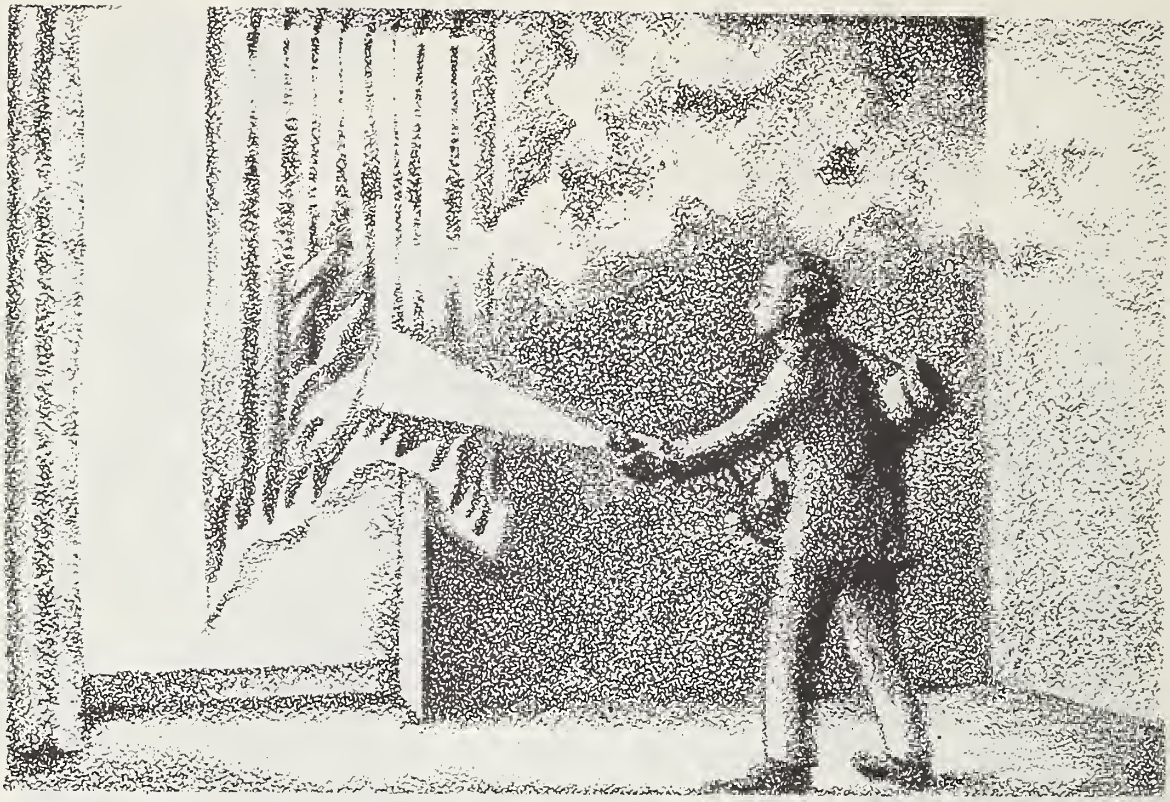
All measures included in the proposed Fire Defense Program deal with the extraordinary requirements of nuclear fire; yet in varying degrees each measure will strengthen peacetime fire activities as well. Because fallout shelters would be used primarily during an attack, the measures for defense of shelters by the occupants have less peacetime applicability than the others. Nevertheless, specific shelter defense measures are not wholly without peacetime benefits; special firefighting equipment in shelters might prove useful in controlling a peacetime fire in the building. Likewise, a trained shelter fire guard would be better prepared to prevent and help suppress normal peacetime fires.

Except for defense of individual fallout shelters, and the fire damage assessment system, all measures in the proposed fire defense program are extensions of peacetime fire control activities. Thus, in varying degrees the wartime measures would be closely related to peacetime fire activities, would be usable in peacetime, and could contribute a great deal in peacetime emergencies. Indeed, after the proposed program is underway, distinguishing between normal peacetime fire control and extraordinary preparations for wartime will likely be a greater problem for OCD than integrating fire defense with peacetime activities.

Cost-Sharing Assumptions Used During the NFCS

While the proposed Fire Defense Program is being implemented, it will be necessary from time to time for OCD to decide how much of the cost and effort of developing, implementing and maintaining each measure to assume. Simply stated, the formula could be:

1. Determine the total requirements for wartime.
2. Subtract the normal requirements for peacetime.
3. The remainder represents the amount to be shared by OCD.



Shelter defense measures are not wholly without peacetime benefits.

However, few of the program's measures can be treated by this simple formula. Although informed judgment will often be the best - often the only - means available at the time, a few guidelines will help.

During the Analytical Phase of this study, it was necessary to estimate OCD's share of the cost for each measure. Although each measure was analyzed individually, some of the constant assumptions used should be clearly understood. These assumptions were:

1. OCD would assume the responsibility and cost of developing and testing equipment and materials for measures primarily for nuclear fire; e. g. window shielding, smoke screen system, emergency water, aerial retardants in urban areas, resource inventory and retrieval equipment.

2. OCD would share with local communities the cost of applying protective measures to approved community shelters; e. g. inspection and rating, fireproof roofing, shelter fire suppression equipment, auxiliary water, and shelter fire guards.

3. OCD would assume the responsibility and cost for developing and testing materials and aids required for all training courses in the fire defense program.

4. Except for salaries and travel of trainees, OCD would assume the responsibility and costs for conducting National Nuclear Fire Leadership Training.

5. OCD would assume the responsibility and cost of preparing and distributing the TV and Radio Citizens Information Kits.

6. When the peacetime benefits and extraordinary wartime benefits can be identified for a measure, OCD would share with states and other Federal agencies the costs of planning and implementing the extraordinary portion. This should apply to any part of the program - protective measures, plans, or support activities.

7. OCD would continue the research necessary to strengthen the fire defense program.

Though they have peacetime benefits, some worthwhile fire defense activities cannot be started without cost-sharing, or even assumption at the outset of total costs by the Federal government. This should be kept in mind when using the above guidelines.

Additional Guidelines From An Improved Data Base

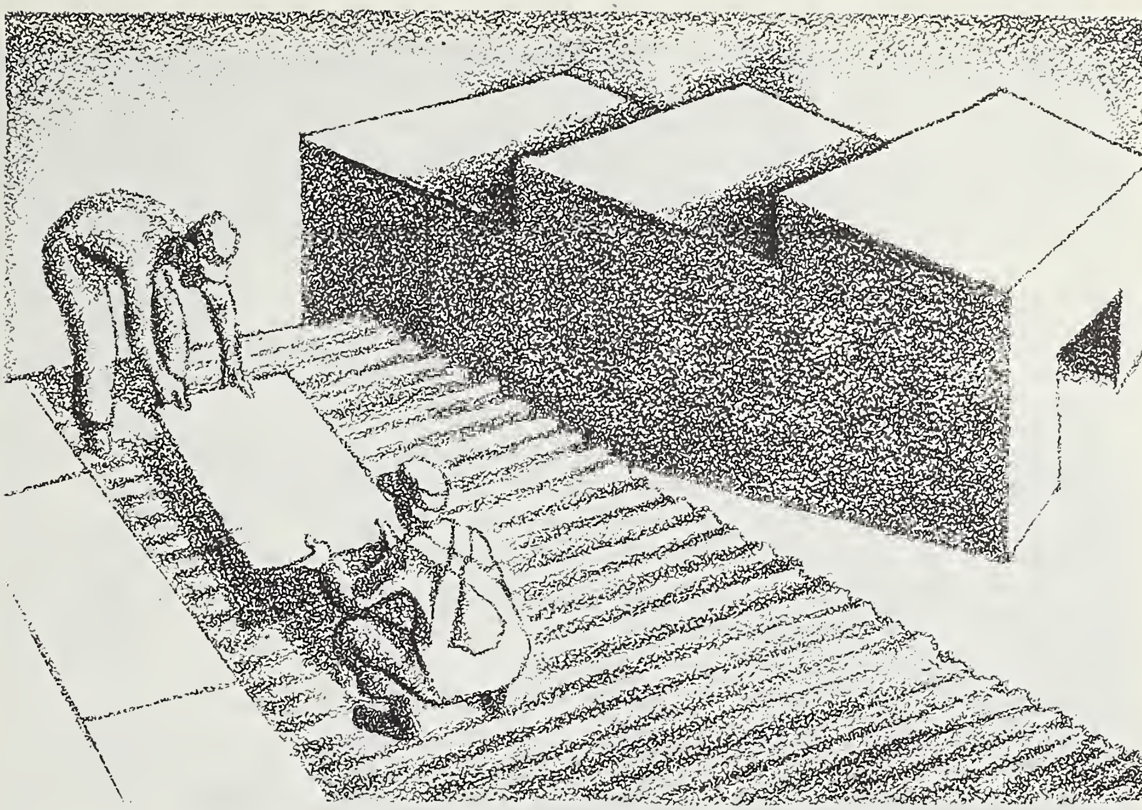
When implementing the Nuclear Fire Analysis (p. 62), it is envisioned that OCD would furnish planning assumptions to states and localities as necessary. Included would be hypothetical nuclear attacks and analysis of fire effects to be expected from the attacks. In this way, the analysis and subsequent fire defense planning done by each community in the United States would have a common problem-oriented base.

Using the same information developed for the Nuclear Fire Analysis, OCD could develop an automated information system which would help make decisions pertinent to nationwide programs. The attacks gamed during the National Fire Coordination Study could be used as basic input for the system. The backup data (65) for the National Fire Coordination Study's Analytical Report contains sufficient information to get the system started. As the Nuclear Fire Analysis System supplies new information, the system's data base can be strengthened.

The use of such a system is demonstrated in the Analytical Report; after plotting the ground zeros for the hypothetical attacks used, groups of ground zeros were identified in disaster areas requiring united command and coordination. This information led to a decision that 550 nationally trained nuclear fire leaders were required. This same basis was used to establish the total number of infrared mapping units required during a nuclear attack. Estimating other requirements involved different data bases; several were used - population, square miles, land area. These and other pertinent data would be a part of the decision information system.

With the above system in operation, it would be possible to assess the total requirements for major components of the fire defense program accurately enough for nationwide planning purposes. Moreover, a base would be established for assessing the relative effectiveness of alternative components.

Because OCD's efforts should be focused on the extraordinary requirements beyond normal peacetime needs, it is necessary to know what the normal peacetime requirements are for the measure under consideration. A data base might eventually be established to provide estimates of peacetime requirements for some fire defense measures. For the most part, however, OCD will need to look to other Federal agencies and fire organizations for this information. With OCD's decision information system estimating total fire defense needs, and other Federal agencies and fire organizations estimating normal peacetime needs, the extraordinary requirements can be more clearly seen.



VI PROTECTIVE MEASURES AND EQUIPMENT

PROTECTIVE MEASURES

Alternative protective measures were analyzed during Phase One and the most effective of these measures are included in the proposed fire defense program. Supporting data for these measures are contained in the Analytical and Phase One Reports. Each are described briefly in Chapter IV and recommendations offered for their implementation.

Since completion of Phase One, additional worthwhile measures have been identified; they are described in Chapter IV. Supporting data for these new measures follows:

Fireproof Roofing for Shelter Buildings

Experience from past fires in both urban and rural areas has shown the advantages of using fireproof or fire resistant materials for roofing construction. The need is particularly important for shelter facilities. During peacetime, roofing that

ignites from fire brands can usually be extinguished at an early stage with adequate patrol and suppression forces available. (There are some notable exceptions.) During wartime, however, radioactive fallout might prevent firemen from exposing themselves to suppress ignitions from fire brands. Thus, shelter buildings capable of resisting exterior ignitions due to fire brands or radiation would offer the best protection for persons inside.

A study of the characteristics of 102 fallout shelter buildings in 24 cities has indicated fire resistant construction to be prevalent (100). However, there were no specific references to the proportion of shelter buildings having combustible roofs. The study showed approximately two-thirds of the surveyed buildings in downtown areas, and one-third of those in residential areas, exposed to ignition from nearby structures. In addition to this radiant heat exposure, these same buildings would be susceptible to roof ignition from burning brands <u>if</u> the roof construction were not of a fire-resistant nature.

The shelter facilities needing roofing treatment to reduce combustibility would be identified by inspecting and rating shelters for fire vulnerability. This survey would indicate the size and location of shelters needing treatment. Assuming that one-fifth of the shelter facilities available on June 30, 1965, needed this treatment, 38,298 facilities in the United States would require some measure of fireproofing for the roof surface (1/5 of 191,491 facilities). At approximately $1000/shelter ($5/100 sq. ft.; 10,000 sq. ft. ave. roof size), the total cost would be about $38.3 million. Peacetime benefit costs would be approximately one-tenth of the total or $3.83 million; wartime benefit costs would total $34.5 million. If OCD shared with cities and communities 50 percent of the wartime costs, their share would be $17.6 million.

The number of lives saved as a result of this roof treatment would depend upon the fire limiting characteristics of the building and the number of shelter spaces involved. With an average shelter occupancy of 500, 19.1 million people could benefit from more complete protection from fire for their shelter facility.

Past fires have shown that buildings with roofing that ignites from fire brands would be less suitable for shelter facilities. U. S. Forest Service Photo.

Shelter Fire Suppression Equipment

This measure is concerned with fire suppression equipment and accessories which can be used to extinguish shelter fires during emergency situations. Most shelters have the regular components of chemical fire extinguishers, standpipe hose connections, and occasionally sprinkler systems. In target areas the standpipe and sprinkler system may be rendered inoperative due to breaks in the line and loss of water pressure. For this reason, additional suppression equipment is needed.

Chemical tank-type extinguishers are good supplementary protection equipment, but also needed are portable extinguishers which can utilize water and be refilled quickly for continued use. The combination of five-gallon stirrup pumps and breathing masks appears to offer the most effective equipment for the least investment. The shelter requirements for stirrup pump - smoke mask measure are explained in a report by IITRI (99). The requirements recommended in the report vary from one "unit" (pump and masks) for each 1250 square feet of normal shelter area, to one unit for each 5000 square feet in shelters able to withstand unsuppressed burnout.

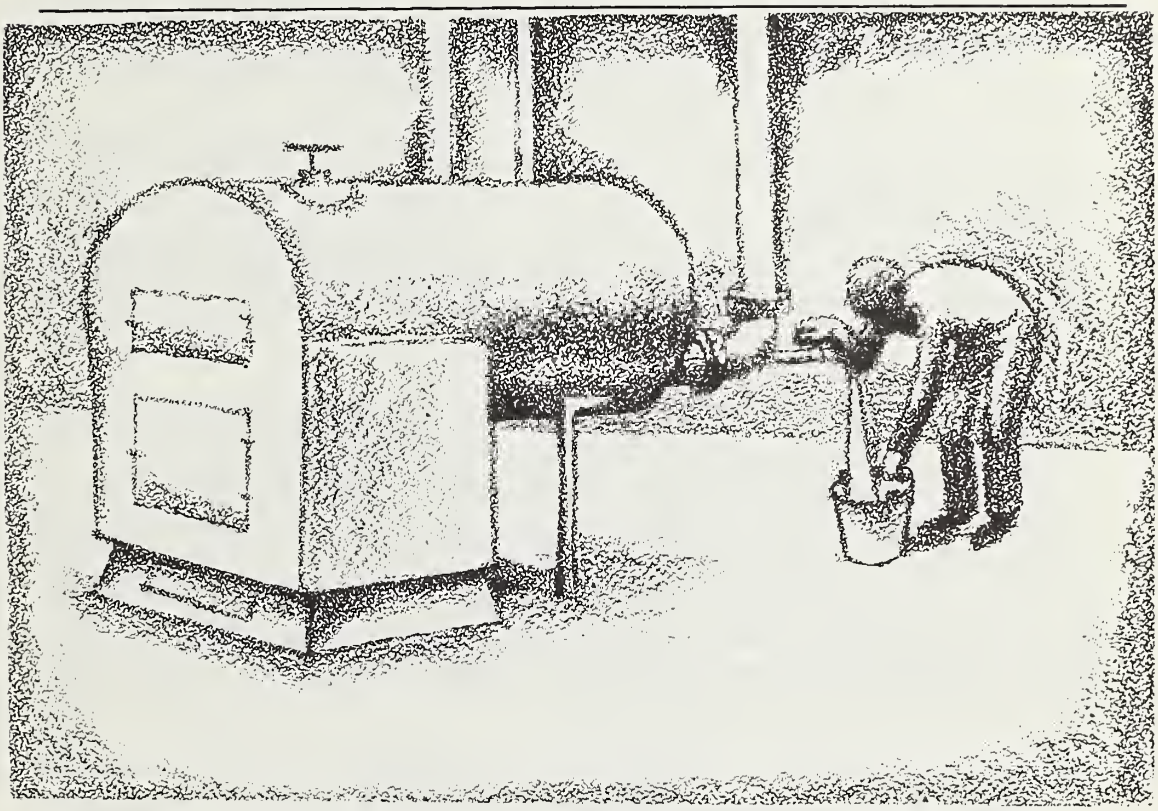
The concensus among professional fire services personnel involved in the National Fire Coordination Study was that supplementary shelter fire protection equipment must be simple and require very little prior training by the user. Furthermore, the equipment must be portable so it can be easily moved about within the shelter, and it must be able to utilize the resources at hand (stored water).

Design engineering work done by IITRI has identified essential fire suppression equipment and supplies for shelters. In addition, IITRI presents guidelines covering selection of equipment, instructions for its use, placement and maintenance schedules. These guidelines will be useful when preparing the fire defense plan for each public fallout shelter (46).

Auxiliary Water Supplies

Pre-emergency planning for shelter fire protection must include the use of auxiliary water sources within or adjacent to the building, and the development of additional water sources if needed. In potential target areas, a "water budget" should be planned, on the assumption that water from mains will be unavailable and

water for fire protection will come from trapped or stored water, or from other supplementary sources. The "water budget" determined for each shelter should include not only how much water would be available from various sources, but how accessible the water is, and where it is located. This information will be used to determine if more auxiliary water is needed and where it should be located.



Auxiliary water, how much-----how accessible-----and where located.

Some of the taller buildings currently maintain a water tank on the roof for sprinkler or standpipe use in case of loss of normal water pressure. There may be peacetime application for this supplementary tank but if blast causes damage to the water lines in the area, it may also damage storage tanks.

During Phase One, the costs and effectiveness of high-expansion foam generators in shelters were analyzed. Effectiveness was impressive but costs were very high (63-95). Moreover, trained firemen are necessary to apply the foam successfully. When supported by extinguishers typically found in shelter buildings, the portable water extinguishers and heat masks, described earlier, (99) provide more feasible protection. The pumps are mobile, simple, and would be equally as (perhaps more) effective as the foam extinguishers. Investment for foam extinguishers were approximately $3000/200 shelter spaces (about 2000 sq. ft. of floor area) (94). Portable water extinguishers, five-gallon capacity, costing about $50 per unit can be used to protect shelter area of about 4000 square feet, (46) provided an adequate water supply is available. Thus, for one-sixtieth of the foam cost, twice as much floor space can be protected. Although foam has the advantage of conserving water, the simplicity and low costs of the pumps justifies additional expenditures to make available a dependable source of water.

The projected cost to OCD for implementing the foam measure was $1.5 billion. The equivalent cost for portable water extinguishers and masks would be approximately $25 million if all the shelter facilities would need to be supplied with portable water extinguishers; in this case the cost to OCD per life removed from fire risk would be $1.16 for portable water extinguishers; $138.00 for high expansion foam. Since some shelters are probably already equipped with portable water extinguishers, the actual cost to OCD would be somewhat less.

Shelter Fire Guards

A recent study by Dunlap and Associates has emphasized the importance of having a trained shelter manager for each public shelter (39). Because the threat from fires spreading in or near the shelter building can have serious consequences, we have included shelter guards in the proposed fire defense program. Serving as a member of each shelter manager's staff, these guards would supervise the operations for defending their shelter from fire.

The Shelter Fire Guard would be responsible for organizing fire prevention and suppression activities for the shelter facility. If nuclear thermal fires occur, they must be extinguished; a patrol may be needed to prevent or control accidental fires occurring within the shelter building, and extra protection

measures will be needed if the shelter is threatened by exposure fires. The Shelter Fire Guard is the fire control officer during the time the shelter is occupied.

One study designed to determine the number of shelter managers needed by the year 1970 utilizes an "Intermediate Projection" based on the assumptions that:

1. All cities of 25,000 or more permit free movement to shelters within their boundaries,

2. That shelter spaces in rural areas are fully utilized.

Under these circumstances, a minimum of 652,000 shelter managers would be required by the end of fiscal 1970 (39). Since at least one shelter fire guard is needed to serve on each shelter manager's staff, a minimum of 652,000 Fire Guards are needed.

Regarding the effectiveness of shelter managers, this same report summarizes the expected loss of life as a percent of total shelter population that would result if no shelter manager were available, if there were prepositioned guidance materials, and if there were no guidance materials. The presence of a shelter manager will save eight percent of the sheltered population over the case where only prepositioned instructional material is available and 16.8 percent over the case where neither a shelter manager nor instructional material is available. The study indicates that if no shelter manager is available, fires, poor shelter security, inadequate temperature, ventilation, lighting and communications can cause 11.5 percent expected loss of life within the shelter. In addition, there would be loss of life due to inadequate quantities of water and food and insufficient radiological monitoring capability. This would indicate that a Shelter Fire Guard on the shelter manager's staff would be nearly as important as the shelter manager himself.

A trained shelter manager is likely to save about 30 or 40 lives in the event of nuclear attack at a cost of about $3 per life saved (39). It seems reasonable to assume then that the Shelter Fire Guard would increase this life-saving potential at little or no additional cost per life saved because of the differences in training costs. Shelter Fire Guard training will be relatively inexpensive compared to Shelter Manager training. The Shelter Guard training can be readily incorporated into current industrial brigade and fire service training programs. Direct cost to OCD

would include preparation of Shelter Guard training material for classroom use and inclusion in handbooks of guidance materials for shelter managers.

PROMISING PROTECTIVE MEASURES WORTHY OF ADDITIONAL STUDY

In addition to the protective measures recommended for the proposed OCD fire defense program, several measures and pieces of specialized equipment show promise but need additional study. With additional, some of these measures might well affect the implementation of the proposed OCD program.

Window Shielding. -- The principle behind this measure - preventing primary ignitions resulting from a thermal flash - is sound, but development projects are needed to design and test alternative types of shielding. Three categories of shielding are recognized. One would be designed as a "one-shot" coverage to prevent the initial flash from reaching the interior fuels; it would be destroyed by the blast wave. Windows are broken by the blast wave out to about the .5 psi pressure contour and thermal protection that was associated with the glass, such as thermotropic coverings or diffusion - attenuating type glass, would be lost in the first blast wave. The second type of window shielding would be designed to withstand multiple blast waves resulting from a time-spaced weapons attack. This approach would be more expensive and more difficult to apply but would offer some protection from more than a single weapon attack. The third type of shielding would be designed primarily for protection against exposure fires. The ultimate in shielding would be a combination shield that would prevent thermal ignitions during a multiple attack and, in addition, function as an insulator to prevent exposure fires.

Smoke Screen Systems. -- It is well recognized that megaton yield nuclear weapons are capable of igniting urban and rural fuels over large areas. The purpose of the smoke screening measure is to modify the atmospheric conditions between the region of thermal flash and the earth's surface in order to reduce the amount of radiant energy reaching the ignitable fuels. Research on this problem had identified the most desirable smoke characteristics for attenuating thermal energy, the weapons effects areas where smoke would be most effective, and some types of equipment, with costs, that could be adapted for use in an operational system (41) (19). In another report (66), a panel of nuclear effects

experts have concluded that smoke screening would be effective only in areas of marginal thermal threat. That is in the area between the five psi line and the line of maximum distance for ignition of the most susceptible fuels. Inside the five psi contour, secondary ignitions are likely and while smoke screens would reduce the number of ignitions within this area, it would be most effective outside the five psi limit (66).

Early cost estimates for an operational smoke screen system were roughly $100,000 per square mile (41). A more recent study places the cost for a reliable smoke generation and control system in a range of $2,400 - $4,200 per square mile (19).

There are additional problems concerning use of an operation smoke generation system:

1. A smoke screen system, <u>by itself</u>, would probably not be an adequate thermal countermeasure. Exceptions might include key facilities (hospitals, schools shelters) on the outer limits of the smoke generator network or in rural target areas.

2. A false alarm or accidental activation of the system would probably generate a violent public reaction.

3. The smoke screen countermeasure would have no peacetime application.

4. A dense blanket of smoke over an area, even during a wartime threat, might cause an unacceptable psychological response by the public.

This question would need to be answered: Do you protect the public in spite of itself with the most effective countermeasures; or do you select the countermeasures that have a better chance of gaining public acceptance but are somewhat less effective?

<u>Emergency Community Water</u>. -- The blast effects created by a nuclear explosion would probably partially or totally disrupt the normal water supply networks in urban target areas. Loss of water would be critical for protection and survival in the area. Project 229 administrative studies have substantiated the well-known need to develop an emergency community water supply that would be mostly independent of the existing system and could be activated during water storage emergencies. Following a nuclear

attack, water would be needed in large quantities for fire suppression, and perhaps equally important, for decontamination purposes. Fortunately, many major cities and towns are situated along rivers or large bodies of water; thus, a source of water is available if it can be used.

Some communities presently provide for use of supplementary water. In Bayonne, N. J., water can be drafted from the surrounding bays and relayed to any section of town as needed (31). In New York City, a super pumper with supplementary hose tenders is in operation, capable of drafting large volumes of water from rivers or bays and transporting this water under pressure for long distances (96). This is an expensive, specialized piece of equipment that can probably be justified from the standpoint of providing water for peacetime emergencies and wartime disasters, as well as in a metropolitan area like New York City.

We recognize the need to have each community develop its own supplementary water supply. The need could be identified more specifically in the Nuclear Fire Analysis for the community.

Treating Combustibles. -- A peacetime fire prevention benefit would be realized if flammable household materials, such as upholstery, drapery, and bedding could be manufactured with some measure of fire resistance.

One report suggests that additional research in the area of reducing initial ignitions be concerned with the development of permanent fire resistive treatments that meet with ready public acceptance. It is also stated that it might be difficult to gain acceptance of major changes at the manufacturing stage but approaches such as the incorporation of felted asbestos liners under furniture fabric covers might solve the problem (101).

Utilities and Energy Sources. -- The fire threat here is concerned with the frequency of secondary ignitions resulting from electrical shorts, gas leaks, and similar malfunctions caused by blast effects. Current OCD doctrine states that householders should turn off electrical, gas and water services at the service entrance in the event of an attack warning. These instructions are not practical for apartment buildings unless only a few units are involved, and do not apply to public shelter buildings (24).

Results of a recent study by Stanford Research Institute indicate general agreement with this doctrine (55). It concludes that fire losses in unattended buildings can be reduced by about two-thirds by cutting off electricity at the source or turning off all energy-using processes at points of use. It suggests however, that disconnecting energy sources, particularly for shelter facilities, would have certain disadvantages which must be weighed against the advantages gained in preventing fires.

There are two situations that need to be studied in relation to utility shut-off. The problem is obvious in target areas, but consideration should also be given to non-target communities that have taken shelter from fallout. We get some insight into this problem from a report by System Sciences Company (23). The company studied the ignition frequency that might be expected, and the probabilities of fire spread in four communities where the population took shelter following warning to avoid impending fallout. The study concluded that there was less than ten percent probability of a spontaneous fire during the first day among the buildings from which the occupants had departed, especially if the inhabitants were instructed on safety precautions prior to leaving their homes.

Aerial Retardants. -- Many of the administrative fire studies supporting both Phase One and Phase Two of the NFCS have demonstrated the importance of insulating exposed fuels to reduce the rate of fire spread. Fires spreading in wildland fuels can be stopped or slowed materially by using retardant chemicals applied from aircraft. It is also common practice to use aerially-applied retardants to protect individual structures or improvements in the path of a spreading fire. But little is known of the feasibility, effectiveness and methods for using aerial retardants to protect structures from fires spreading in urban areas, special study is needed to exploit this apparent opportunity.

Sprinkler Systems. -- Under normal operating conditions, sprinkler systems can provide effective protection for all types of structures. They also have the potential to provide some effective protection in emergency situations. A sprinkler system has been designed specifically for extinguishing primary fires resulting from a thermal flash (50). This system differs from the normal sprinkler system in two important ways:

1. It is activated by a photoelectric flame detector rather than a temperature sensor.

2. The system shuts off when the flame is extinguished to conserve water.

The system is designed to use an independent water supply (1000 gallon tank or multiples thereof) pressurized to provide a constant flow, and an auxiliary power source in case of community power failure. With this system only those rooms that would be exposed to the thermal flash would need protection.

The primary disadvantage of a sprinkler system is its vulnerability due to structural damage from the blast wave. Most buildings within the five psi pressure contour would be severely damaged, but outside the blast damage area sprinkler systems could be effective, particularly in the more substantial buildings housing public shelters.

SPECIAL EQUIPMENT

During a nuclear attack, unusual demands would be placed upon the fire services to assemble manpower and equipment and to assign and reassign available equipment to control selected fires. Even in peacetime, the fire services and civil defense offices mobilize large quantities of equipment and manpower resources for fire-fighting and other emergencies. Although these peacetime emergencies are sometimes severe, they are not nearly as comprehensive and complex as the fire situation would be during an attack.

Fire Resource Locator Equipment Presently in Use

The data storage and display equipment presently used for handling this job, together with the communications networks, are generally referred to as dispatching systems. Except when automatic response systems are available, the dispatcher estimates the fire probabilities, calculates needs, and orders resources into action. He makes the decisions until a responsible officer arrives at the scene and establishes communications. At that time, the dispatcher may cease to make major decisions about this fire but he relays requests and orders. He may, however, handle several fires simultaneously, as they are either controlled in the initial stages or develop into major problems. He should keep a record of all actions and must be prepared to brief others on the situation at all times.

Even in peacetime, the fire services and the Civil Defense offices mobilize large quantities of equipment and manpower resources for firefighting. Los Angeles City Fire Department photo.

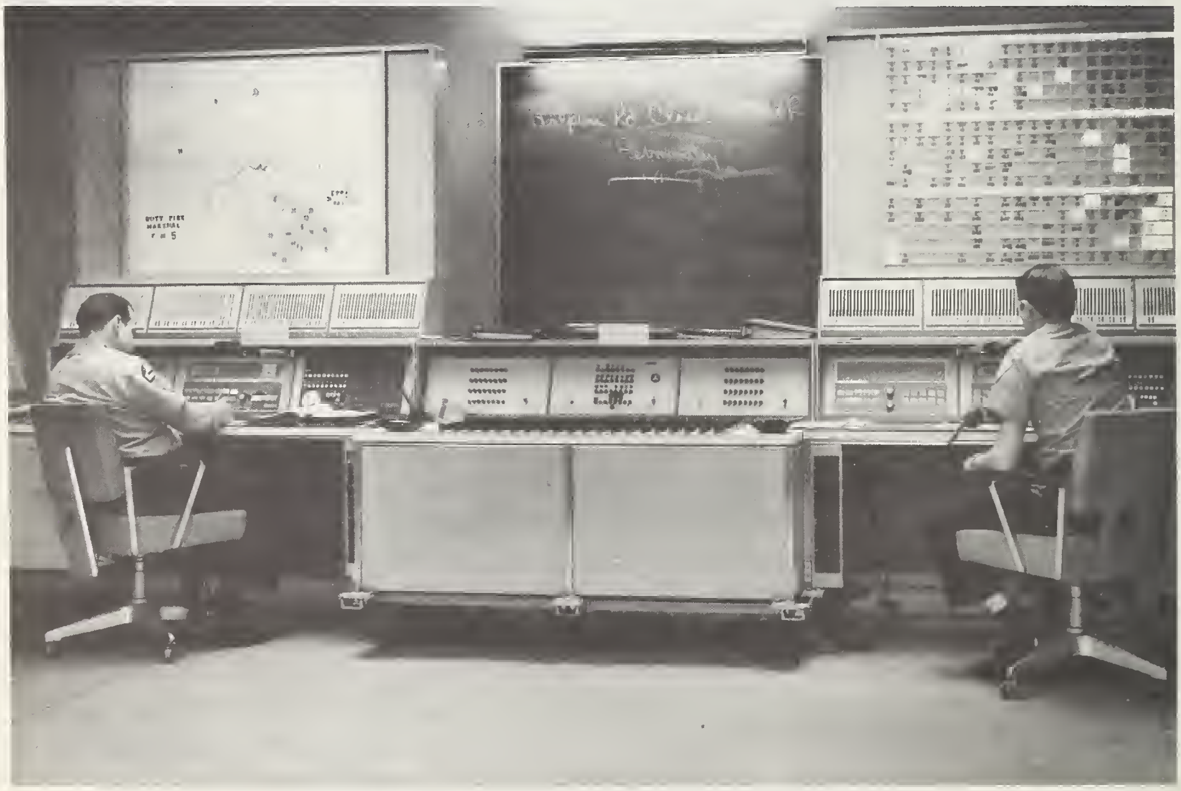
Nine dispatching systems were examined in depth. Several others like those at Roseburg, Oregon, and at the Watts Riot, Los Angeles, California were observed in connection with other studies.

At Elko, Nevada, joint dispatching by two government agencies wrestled with an uncommon brush fire emergency burning 278,000 acres. In a three-day operation, firefighters mobilized resources that included 235 vehicles, 52 bulldozers, 22 air tankers, 11 helicopters, 32 other aircraft and 2,500 men. A better system to store and display resource data was needed.

In Orange County, California, the California Division of Forestry handles dispatching of fire and rescue for several services: the Orange County Fire Department, the California Division of Forestry, Orange County Units, the Coordination of City and Military Units on Mutual Aid problems and four-county Coordination for the California Disaster Office. The two dispatchers constantly

on duty frequently handle 50 resource units on initial dispatch from 22 locations. Annually, they deal with approximately 1,800 calls for action, 300 calls for relay to other departments, and 25 mutual aid problems. The county's population is 1,300,000. A separate communications room and staff provide support with the five telephone lines and nine radio nets. These dispatchers said that six months on-the-job training was barely adequate.

The Emergency Operating Center for Montgomery County at Rockville, Maryland, is designed to provide continuing services in time of nuclear attack. This hardened facility, with sophisticated communications and display consoles, cost $1,100,000. In addition to providing emergency services, it is used by the police and fire departments for every-day, around-the-clock operations. The 24 fire companies and two independent rescue squads use 166 vehicles on the 525 square mile area containing 405,000 residents. This excellent facility is expandable to receive more resources but is primarily limited to the one county area. Considerable training and skill is required of the operators.



The Emergency Operating Center for Montgomery County at Rockville, Maryland is designed to provide continuing services in time of nuclear attack. U. S. Forest Service photo.

Present systems rely heavily on mental recall, on tedious logging of data, and on the retrieval of this information from the log. They have been developed for a specific geographic area, using known available resources. They require up to six month's training and are often partially designed by and for the dispatcher who uses them. Nearly all tasks in the existing systems must be performed by the skilled dispatcher and cannot be segmented and assigned to assistants. Thus, the time and energy of the most skilled and experienced men is not available for important problem analysis.

Only a portion of the hardened Emergency Operating Centers are in daily use by the fire services for peacetime dispatching. If an emergency occurred, personnel activating those facilities not used in peacetime would probably not be skilled in using the equipment. Several hours or days might be required to develop ability to operate the equipment and the system in the EOC. Most available systems are rigid in that they are designed around fixed geographic locations and can use only resources that are known and are at known locations.

Existing systems do not display important information in a way that provides a constant comprehensive picture of:

1. Resources available.

2. Resources in-transit.

3. Resources committed.

A Resource Locator for Nuclear Fires

As existing facilities were studied, it became obvious that present methods were so dependent on skilled personnel and on known resources that a simple, flexible system was needed as backup for the permanent facilities to deal with major disasters and the chaos following a nuclear attack. This would include a dispatching system, with equipment, to augment present systems when a complex fire problem develops. It should not require many hours of training. It would relieve the dispatcher of tedious tasks and dependence on memory so he could apply his ability to analysis and decisions.

To augment present dispatching systems, prototype equipment was developed. U. S. Forest Service photo.

From the studies evolved criteria for a resource locator system which would:

1. Not add materially to the time and effort required, as compared to present systems, unless the benefits are obvious.

2. Provide constant visual display of basic information, and storage, with quick recall of all necessary data about each resource.

3. Provide a guide to the sorting of data about the resources, i. e., display only essential kernels and store others for quick recall.

4. Be primarily manual in operation, but planned for possible future adaptation to mechanical or automated data storage and display.

5. Be independent of communications systems.

6. Be reasonably priced so that small fire departments can afford it, and so that quantities can be stocked for emergency use.

7. Have three parts: Inventory, In-Transit, and Assignment; usable separately, but compatible for combined use.

   a. Inventory should display current status of resources by numbers by location.

   b. In-Transit should display the programmed movement of resources from one place to another, by legs of the journey, with reminders of upcoming action.

   c. Assignment should display resources committed by geographic areas, by time periods, and by present planned assignment.

8. Be adaptable to small or large areas, i.e., town, county, city, state, region, or nation.

9. Be flexible enough to accept strange resource items, trace movement over strange routes, and record assignments to varying problem areas.

10. Be expandable enough to handle hundreds of resource items as a fire problem develops, but not cumbersome when using only 25 items.

11. Be simple with not more than 30 minutes required to learn its use.

12. Be portable for easy set-up at temporary emergency headquarters (20 minutes for one man).

13. Be transportable by standard station wagon and by air.

14. Have low power requirements (15 Amperes at 117 volts, A.C. per each 100 resource items).

15. Have moderate space requirements (1/2 cubic foot item).

16. Offer legibility of displayed data at ten feet or more.

To meet the above criteria, prototype equipment was developed and is presented as a separate package. Deliverable items include:

1. A prototype model to handle 25 resource items.

2. A manual of procedures, instructions and maintenance.

3. A report of the state of the art, showing alternatives considered and estimated costs.

4. Recommendations for subsequent development and for other applications of this equipment and system.

5. A statement of estimated costs to produce working models, various configurations and quantities.

The prototype and related reports are considered as Item 4.e of Project Order OCD-PS-64-229. The hardware is in custody of the Forest Service, Division of Fire Control. One copy of each of the following reports is delivered to OCD:

"State of the Art in Disaster Control Display Systems" (4)

"Recommendations for Subsequent Development and Other Applications of Disaster Control Center Equipment" (3)

"Operations and Set-up Manual"

All reports are by Bio-Dynamics, Inc., Cambridge, Mass.

The prototype model and the system should be evaluated in the field before working models are purchased for exhaustive testing. The prototype might be assigned under cooperative agreement, to the Forest Service for about 90 days of field evaluation. If results are favorable, about ten complete working models should be purchased for field testing by fire services in both urban and rural areas. By July, 1967, there should be sufficient information available to indicate the direction to take with this system.

Equipment for Citizens Fire Suppression

Householder fire suppression equipment requirements will vary by localities, but the most effective combination of equipment for universal use in each household would be a five-gallon portable water extinguisher, a chemical extinguisher suitable for grease and electric fires, and a garden hose. Additional auxiliary water for firefighting purposes would be desirable.

Fire suppression equipment for use in homes should be purchased and maintained by the householder. Although purchase of the equipment would be voluntary, CD officials and the fire services could encourage it during Householder Self-Help Training and in fire prevention campaigns.

As the Urban Fire Defense Support Fireman Program advances, it may be advisable for OCD to share the cost of firefighting equipment for their use. In addition to the householder fire suppression equipment described above, these support firemen should have available hand fire suppression equipment commonly used in the area.

The chance of successful fire control is assured if prior plans are available and carried out. Los Angeles County Photo.

VII THE NUCLEAR FIRE PROBLEM

Three hypothetical nuclear attacks supplied by OCD were used with research and administrative study findings as a basis for defining the nuclear fire threat. This threat is specifically expressed in lives exposed to fire risk and percent of land area burned. A rural fire spread model was used to estimate the extent of fire spread over the total land area of the United States. To determine the fire threat in urban areas, a detailed assessment was made of blast, fallout, and fire damage to three large cities. Results of the three-city assessment were then extrapolated to urban areas throughout the nation.

The damage assessment models used, assumptions made, research findings considered, analytical methods employed, specific details of the fire threat, and effectiveness of each countermeasure, are available in Bibliography references numbered 23, 32, 63, 64, 65, 88, and 95. A summary of the findings from Administrative Studies may be found in Appendix E of this report. Pertinent research findings are converted to operational guides and summarized in Appendix F.

The Nuclear Fire Threat

Assuming that normal peacetime fire control activities would be in effect but that no extraordinary preventive or organized fire suppression measures were taken, the nuclear fire threat to the United States is determined to be as follows:

1. Nuclear fire is a lesser threat to lives than blast and fallout, if the population is in residences. The overwhelming effects of blast and fallout leave fewer persons alive to be threatened by fire.

2. Nuclear fire is a significant hazard for a well-sheltered population. More people are alive in areas threatened by fire, hence more are exposed to fire risk.

3. Nuclear fire will become proportionally more serious as progress is made in protecting lives from blast and fallout.

4. Nuclear fires burning in rural areas will be a serious problem under certain weather conditions. Approximately 10 percent of the land area of the United States could be burned.

Fire Problem in Target Areas

In target areas, the threat from nuclear fire would be complicated by blast damage and fallout. An extremely difficult fire control problem would exist. The picture is one of considerable destruction near the burst, an area in which it is inconceivable that any operations could be performed until long after the attack. Further out, the blast destruction becomes more moderate and at about the 5 psi line areas might tend to become passable. Within a large fraction of this region, and somewhat farther out, the frequency of building fires is very high. With increasing distance from the burst, the fire incidence begins to diminish and there is a region of 10 percent to 90 percent fire damage which can be considered a fire front. Beyond this region the incidence of fire drops rapidly. Most of the area will be covered with fallout which will begin to arrive in about one-half hour after the surface burst of a large weapon, reaching lethal levels for unsheltered persons very quickly thereafter.

In the close-in regions of excessive rubble, the surviving firefighting forces would be considerably restrained in their operations. Firefighting would be mostly ineffective and life-saving operations would be quite limited. At the perimeter (fire front) rescue, movement of survivors, and selective fire suppression may be undertaken with significant likelihood of success assuming that additional attack weapons do not subsequently destroy the area. However, success would be critically dependent on a high degree of planning, direction, communication, and coordination, especially in view of the very short interval of time for fire operations prior to the accumulation of lethal levels of fallout (23).

The extremely complicated environment which would follow a nuclear attack suggests ignition prevention measures taken prior to attack are equally as important in the fire defense program as organized fire suppression during and following an attack.

Fire Problem in Areas Affected by Fallout but Not Blast

To complete the picture of the fire problem that might result from an enemy attack, a study was made of four selected non-target cities to determine what the fire problems might be when the population vacates homes and businesses to seek shelter from impending fallout (23). Under nearly any range of attack assumptions, there would be a significant segment of the population that would not be in an immediate target area. Would these survivors be threatened by fire? How serious would this threat be? What can be done to reduce this threat? From the study of the four selected cities, we determined the number of initial fires to be expected, the possible extent of spread, and the problem of fire detection, control, and extinguishment in a fallout-contaminated environment.

When studying the four cities, consideration was given to both the probability of an accidental fire and the extent of the expected fire spread damage if such an initial fire did occur. Significant factors were environmental conditions during the attack, readiness of the population, attack sizes and types, available firefighting resources, and operational factors. Prevailing weather conditions at the time of the simulated attack were used. It was assumed the population was warned and had occupied the available shelters in each of the four cities. Current firefighting resources in each city were available; all off duty firemen had reported to their stations for the

emergency; there was excellent direction and control of emergency activities; and there was a communications system providing the fire services with ample information on the location of weapon bursts. The same three attacks used in making the original fire effects analysis for the country were employed. Thus, the data in the non-target city study is compatible with the fire threat analysis for the whole United States.

Results of the analysis indicated that in only one of the four unhit cities was the fallout level so high that fire services might not be able to cope with a spreading fire threatening an area of shelters. The expected frequency of a fire in this one city during the first day was less than 10 percent and the occurrence of a fire in a potential conflagration area was even less likely. Initial fires could be ignored in many parts of the city since only limited spread would be likely.

In the other three cities, the fallout problem would be much less serious, and the chance of successful fire control is assured if prior plans for coping with the situation are available and carried out.

In summary, for cities not directly hit in a nuclear attack, the likelihood of a spontaneous fire during the first day among the buildings from which the occupants have departed is not high--less than 10 percent--especially if the inhabitants have been instructed on safety precautions prior to leaving their homes. The principal problem, if a fire does occur, is detection, control and suppression in a contaminated environment. To meet these problems, the fire services should prepare plans that include a potential fire spread analysis for their community, a fire defense plan, an established system of rotating personnel exposures to fallout, a shelter evacuation plan, and provisions for decontamination of selected areas. Likelihood of success with such plans is very high.

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APPENDIX A

(DRAFT)

FEDERAL CIVIL DEFENSE GUIDE

PART E, CHAPTER 10

(A Draft of the Proposed Fire Chapter)

FEDERAL CIVIL DEFENSE GUIDE

PART E, CHAPTER 10, FIRE DEFENSE

March 1966

DEPARTMENT OF DEFENSE
OFFICE OF CIVIL DEFENSE

(Subject to approval by OCD and coordination with other agencies of the Federal Government, this exhibit is adequate for interim and long-term guidance.)

CONTENTS

FIGURES

INTRODUCTION AND OBJECTIVES

Fire would be a significant cause of loss of lives and resources in a nuclear attack. Under certain conditions, people saved by shelters from blast and fallout would be threatened by fire. The resources of the entire community might be seriously threatened. In addition, confusion created by smoke and havoc from large fires could add to the difficulty of post-attack recovery.

The objective of the fire defense program is to identify and execute the most effective combination of protective measures, support activities, and training for each community that will help reduce loss of life and resources from fire.

Although the Federal Civil Defense Program is designed to meet attack situations, state and local civil defense programs are also concerned with preparations to meet peacetime disasters. Fire is always a serious threat to life and property, but fires stemming from a nuclear attack would present a more serious and vastly different problem than normally experienced. The objective of this chapter is to provide guidance for planning, organizing, and achieving effective preparation for fire defense.

It is necessary to integrate fire defense with other activities in the total civil defense effort, thus persons responsible for fire defense

should be familiar with the National Plan for Emergency Preparedness and the Federal Civil Defense Guide, especially the following:

Part A, Chapter 1, Basis of the Civil Defense Program

Part A, Chapter 2, National Civil Defense Program

Part B, Chapter 1, Appendix 1, Federal Civil Defense Act, as Amended

Part B, Chapter 1, Appendix 3, Surplus Property

Part B, Chapter 2, Organizing Local Civil Defense

Part B, Chapter 2, Appendix 2, CD Directors Guide to Citizen Participation

Part B, Chapter 3, Program Planning and Emphasis

Part D, Chapter 2, Appendix 1, Description, Storage, and handling of public fallout shelter supplies and equipment

Part D, Chapter 2, Appendix 4, Fallout Shelter Water Requirements

Part D, Chapter 2, Appendix 9, Inspecting Shelter Supplies

Part E, Chapter 1, Appendix 1, Principles of Civil Defense Warning

Part E, Chapter 4, Appendix 1, The Emergency Broadcast System

Part E, Chapter 5, Radiological Plus all Appendices

Part E, Chapter 7, Decontamination

Part F, Chapter 1, Training

Part F, Chapter 5, Financial Assistance plus all Appendices

Part G, Chapter 3, Military Assistance to Civil Defense

Part G, Chapter 5, Actions for Increased Civil Defense Readiness

DEFINITIONS

1. <u>Fires</u>

   Those fires resulting directly or indirectly from enemy attack, including both urban and rural area fires.

2. <u>Fire Defense</u>

   The total concept of defending lives, property, and resources from fires during an enemy attack.

3. <u>Fire Defense Program</u>

   The combination of extraordinary preparation and operations employed to prevent, contain, or curtail the destructive effects of fires during an attack.

4. <u>Fire Services</u>

   Organized urban and rural fire departments and services currently engaged in preventing and suppressing fires.

5. <u>Fire Supporting Organizations</u>

   Organizations whose primary objectives are to support fire services, establish fire standards, or increase the professional ability of fire services.

6. <u>Fire Education Organizations</u>

   Organizations whose objectives are to educate and train personnel in the professional and technical aspects of fire prevention and control.

7. Urban Areas

Towns, cities, municipalities or other legal entities under the protection of organized fire departments.

8. Rural Areas

Forests, other wildlands, flammable croplands and rural communities not under the protection of legally organized fire departments or districts.

9. Protective Measures

Those active and passive measures applied on-site to prevent, control, or prepare to control fires, including measures to: reduce ignition points; reduce thermal effects; reduce fire vulnerability of fallout shelters; organize fire suppression and related rescue activities.

10. Support Activities

Plans or guides necessary to execute the protective measures, including off-site staff support and service.

11. Nuclear Fire Analysis

An analysis of the nuclear fire threat to each community, an inventory of each community's capabilities to cope with the threat, and an evaluation of the effectiveness of alternative protective measures for each community.

THE FIRE DEFENSE PROGRAM

AREAS AFFECTED BY BLAST, FALLOUT, AND THERMAL IGNITIONS

Fallout shelters generally offer complete protection against flash burns from initial thermal radiation, and may provide a small but significant degree of protection against blast. Therefore, we could expect many survivors from the initial weapons effects in the region of one to ten psi blast overpressure. For a ten-megaton surface detonation, this region extends from four to 16 miles from ground zero and includes most of the damaged area.

It is in this area that the threat of developing fires from ignitions caused by both blast and thermal radiation will be encountered. Some places within this general overall fire area may not have fires. These will be areas clear of any fuels, or buildings so located that they are not seriously exposed to the fire. Within these areas, survival is considered probable, especially for people in fallout shelters within the less fire-vulnerable buildings.

Perhaps the most serious complication is the imminent threat of fallout that could hamper firefighting or remedial movement. Some countermeasures could be taken in that short period of time immediately following a detonation and before radioactive fallout arrived. In practice, defensive actions would depend upon the relative

severity of the threats of fallout and fire. Because of this difficulty, it is desirable to provide a high degree of fire protection in fallout shelter areas through a careful selection of such areas and by preparing in advance to prevent or control the fires that might occur.

Efforts by occupants to protect their shelters from fires will be restricted to the immediate vicinity of the shelter or the building in which it is located. Within this area fire guards organized from the shelterees can cope with accidental fires as well as ignitions caused by the radiant heat from the fires in nearby buildings. But the guards must be trained and fire suppression facilities must be available. If a community shelter becomes untenable, shelter management will move people to other shelters or areas of less hazard. Intensity of radioactive fallout will dictate the length of time that shelter occupants can be exposed during the movement without danger.

Even with preventative measures taken before attack, controlling fires during and after an attack presents serious problems. Once started, small fires might coalesce into large fires. Control measures would be needed to extinguish small fires and control the large fires spreading on one or more fronts. Because fires would be so numerous, control must be selective. It may be necessary to leave some areas to burn and concentrate efforts on high-priority fires where control will be effective. Timing will be important. The

intensity or threat of radioactive fallout would control the timing.

Large numbers of people may need to be rescued. For example, it may be better to evacuate people from certain areas than to control the fire threat. Equipment capability and effectiveness would be reduced in blast areas. Finally, the mass public would be involved independently and in support of firemen in controlling fires.

In the close-in regions of excessive rubble the surviving firefighting forces would be considerably restricted in their operations. Damage would be widespread, communications disrupted, and normal mutual aid partners fully engaged; therefore, rescue and movement of the population to safe areas may be the best method. Most life-saving operations will be quite limited in this environment. Outside the area of impassable rubble the fire services should move to the fire perimeter, which may be irregular depending on terrain and fuels. At the perimeter, rescue and fire suppression have a good chance of success.

AREAS AFFECTED BY FALLOUT ONLY

If the inhabitants of those areas affected by fallout only take the necessary safety precautions before leaving their homes and places

of business, there is less than ten percent probability that a spontaneous fire will start among the buildings. But if a fire does start in a potential conflagration area, it could be a serious threat to the occupants of fallout shelters. Conversely, a fire starting in a residential area where homes were widely spaced might have little or no potential to spread. To evaluate the potential fire problem in cities not attacked, it is necessary to consider both the probability of accidental fire and the extent of expected fire spread damage.

All fires occurring within fallout shelters must be detected and suppressed. If a fire occurs outside the shelter, the problems are principally detection, control, and suppression in a contaminated environment. Since radiological contamination would be of varying intensities, the fire services must be able to monitor for radiation, or have this capability directly available to them, and be capable of calculating dose rates.

Actions required to handle fire detection, control and suppression in a contaminated environment include:

1. Preparing a nuclear fire analysis for each community.
2. Preparing a fire defense plan.
3. Establishing systems of rotating personnel exposed

to fallout.

4. Planning for remedial movement of threatened shelter occupants.

5. Decontaminating selected areas at which to control fire spread.

ORGANIZING AND STAFFING FOR FIRE DEFENSE

During wartime, fire defense would be an integral part of civil defense. Part A, Chapter 2, Federal Civil Defense Guide, describes the organization for civil defense.

During an emergency, state governors and chief executives of local governments will assume control of all government and civilian forces and resources subject by law to their authority. Federal agencies will perform activities assigned to them by Presidential Executive Order and provide personnel, materials, and facilities to aid the states as directed by the President. Existing agencies of local, state, and Federal governments will perform emergency activities related to those they perform in peacetime. Therefore, the operational aspects of fire defense are primarily a function of the fire services, operating under the direction of elected officials and with staff service and assistance from other government agencies, including OCD.

The civil defense organization at each level of government - local, state, Federal - should include the fire staff necessary to give support to fire defense, including fire coordinators at the zone, state, and regional, and Federal levels. Figure 1 shows the proposed organization for fire defense and relates it to the Civil Defense organization.

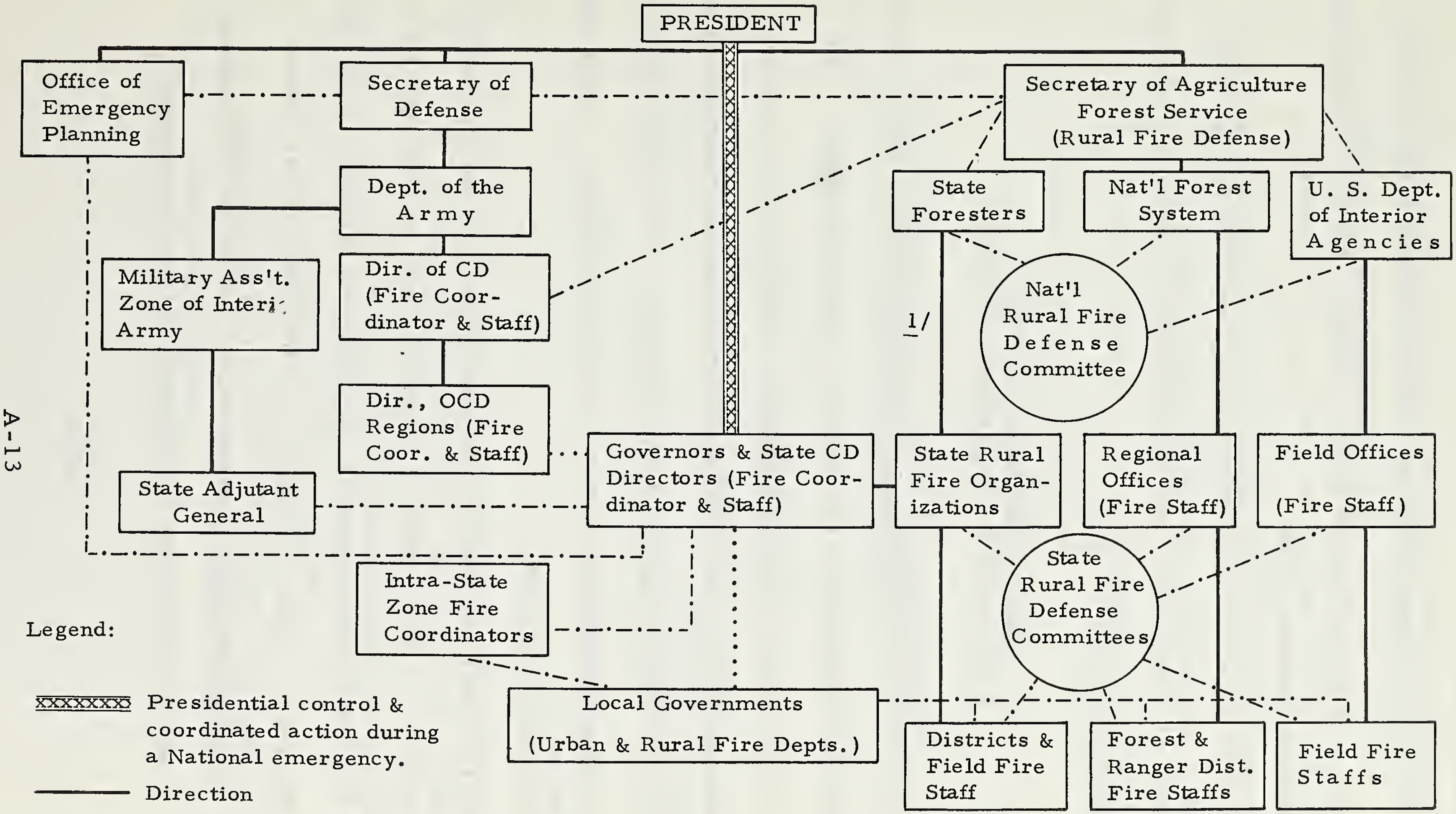
MUTUAL AID POLICY

To make full use of fire control resources, the following policies will guide mutual aid arrangements for fire defense purposes:

1. Each state is encouraged to enact legislation permitting the governor to establish free interchange within the state of fire forces and personnel when an emergency exists. This legislation should provide coverage for personal injuries and liability for damages.
2. Each state is encouraged to enter into interstate compacts as necessary to prepare for fire defense. Regional offices of OCD will aid in arranging interstate compacts.
3. Each state is encouraged to provide for carrying out the above legislation and interstate compacts by assigning fire coordinators as described in the National Fire Defense Plan.
4. Implementing mutual aid on a regional and national basis will be aided by fire coordinators in OCD regions and OCD's National

Figure 1

PROPOSED ORGANIZATION FOR FIRE DEFENSE



Legend:

XXXXXXX Presidential control & coordinated action during a National emergency.

——— Direction

.... Coordinated planning, emergency operations, Federal assistance.

-·-·-· Coordinated planning & emergency operations.

Rural fire defense activities are coordinated with other defense activities through USDA state and county defense boards.

1/ This relationship would be coordination for states where State Foresters are not in charge of Rural Fire Defense activities.

Headquarters.

5. Mutual aid arrangements and training between urban fire services, state and local rural fire services, and the Federal fire services is encouraged.

6. When they qualify under cost-sharing regulations, OCD will share with states the cost of extraordinary mutual aid arrangements for nuclear fire.

FIRE STAFFING FOR THE EMERGENCY OPERATING CENTER

At the Emergency Operating Center, fire staffs will be one of several public services reporting to the Disaster Operations Officer. The fire staff will analyze the fire situation, report fire information to the Operations Officer, help him weigh priorities and make decisions, and carry out the fire aspects of the decisions. To the extent they are available, the fire defense coordinators shown in Figure 1 would serve on the fire staff at the EOC.

The basic fire staff required for any emergency operating center is an operations chief, a plans chief, a resource chief, and operators for the fire communications network. All should be trained in EOC operations (Figure 2). Their duties and qualifications are as follows:

1. Operations Chief. Serves on the staff of the EOC manager who is directing or coordinating the total emergency

operation. He should be a highly qualified fire chief with ability to relate the fire problem to other aspects of the disaster. His duties would be:

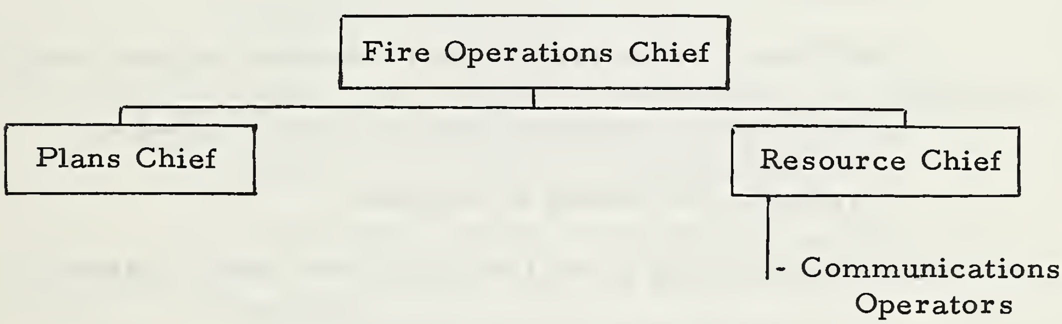
a. Directing the activities of the fire staff at the EOC.

b. Utilizing information and advice from his staff and developing recommendations for necessary action.

c. Presenting these recommendations to the disaster operations officer for action.

Figure 2

BASIC FIRE ORGANIZATION FOR EMERGENCY OPERATING CENTERS



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d. Representing fire defense, and helps make joint decisions when combined problems of fire, rescue, fallout, welfare, etc. are involved.

e. Activating the approved fire defense decisions through his resource chief.

2. Plans Chief. Responsible to the fire operations chief at the Emergency Operating Center. He should be a highly qualified fire chief capable of interpreting burning conditions and estimating fire problems. His duties would be:

a. Utilizing the resources available to him, directing the gathering of information required to assess the fire situation.

b. Receiving, analyzing, and interpreting meteorological data and predicting the effect on fires in the area.

c. Assessing the fire threat to urban and rural areas including predictions of fire spread in the immediate future.

d. Utilizing blast and fallout data developed by other staffs at the center, estimating the constraints placed on firefighting personnel in the area.

e. Recommending to the fire operations officer actions to most effectively reduce the fire threat.

f. Maintaining a current map of fire occurrence, location, size, and spread potential of urban and rural fires.

g. Supervising the fire staff officers assigned to his function.

3. Resource Chief. The resource chief is responsible to the fire operations chief at the Emergency Operating Center.

He should be a highly qualified fire chief who commands respect from fire leaders within the EOC's geographical jurisdiction. He should be familiar with the area, and understand the communications systems. His duties would be:

a. Identifying sources of currently available equipment, manpower, and supplies.

b. Recommending ways in which manpower, equipment, and supplies can be used most effectively to meet the urban and/or rural fire threat estimated by the plans chief.

c. Supervising the fire communications system at the Emergency Operating Center.

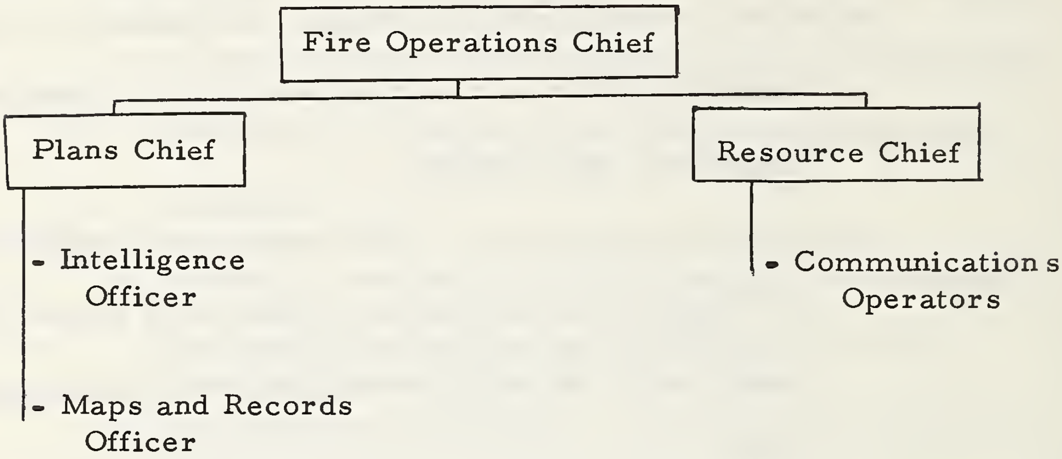
d. Dispatching manpower, equipment, and materials as approved by the fire operations officer.

e. Supervising the fire staff officers assigned to his function.

The basic fire staff could readily be expanded to meet the demands of a growing fire emergency. For example, if it becomes difficult to manage the incoming intelligence, intelligence, maps and records officers can be assigned to report to the plans chief. In this instance the duties of the resource chief would remain unchanged (Figure 3).

Figure 3

EXPANDED FIRE ORGANIZATION FOR EMERGENCY OPERATING CENTERS



If it becomes necessary to expand the entire fire staff operation, additional staff can be assigned under the resource chief and a dispatch chief assigned to handle communications and implement the decisions approved by the fire operations chief (Figure 4).

Under the fully developed organization, the duties of the fire operations chief and the plans chief would remain the same except they would delegate more responsibilities to the staff officers. The communications and dispatching duties of the resource officer would now be done by the dispatch chief. The qualifications and duties of these additional positions are as follows:

1. Dispatch Chief. The dispatch chief is responsible to the fire operations chief at the Emergency Operating Center.

He should be a highly qualified fire chief who is respected by fire leaders within operational range of the EOC. He should be familiar with the area, understand the communications systems, and be trained in EOC procedures. His duties would be:

a. Dispatching manpower, equipment, and materials as approved by the fire operations officer.

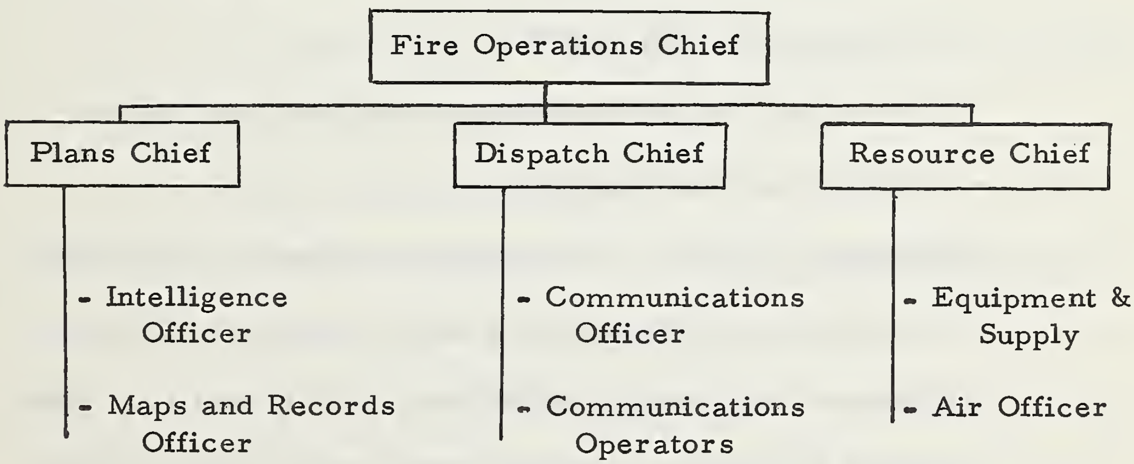
b. Maintaining a visual record of manpower and equipment in-transit, location by area assigned, and reserves available for dispatch.

c. Supervising the communications officer and operators.

d. Maintaining a log of important activities.

Figure 4

FULLY DEVELOPED FIRE ORGANIZATION FOR EMERGENCY OPERATING CENTERS



2. Communications Officer. The communications officer is responsible to the dispatch chief for establishing, maintaining, and operating the communications necessary to receive fire intelligence and transmit fire decisions of the Emergency Operating Center. He should be a qualified communications equipment technician and know how the fire communication nets in the area operate in relation to other primary communications networks. His duties would be:

   a. Determining the type and amount of equipment needed to communicate the fire business of the center to meet the fire threat estimated by the plans chief.

   b. Determining personnel needs for technicians, operators, and messengers.

   c. Supervising the fire communications system at the Emergency Operating Center including its operation, maintenance, and repair.

   d. Adjusting the communications system to meet the demands of the emergency.

3. Intelligence Officer. The intelligence officer is responsible to the plans chief for gathering and putting into usable form all information concerning the fire area. He must be a highly qualified fire officer, familiar with methods used to gather fire intelligence, and capable of relating and analyzing the

factors that influence the behavior of fires. His duties would be:

a. Determining the methods and equipment to be used in gathering fire intelligence.

b. Receiving, interpreting, and presenting all fire intelligence data to the plans chief in usable form.

c. Supervising the intelligence gathering operation at the Emergency Operating Center.

d. Interpreting the intelligence data for the plans chief, as required.

e. Securing and presenting data on the relative importance of facilities threatened by fire.

f. Incorporating blast and fallout data developed by other staffs at the center and estimating constraints placed on firefighting personnel in the area.

g. Maintaining a current map of fire occurrence, location, size, and spread potential.

4. Maps and Records Officer. The maps and records officer is responsible to the plans chief for compiling and displaying, as necessary, all data pertinent to the fire operation at the Emergency Operating Center. He must understand the nature of the large fire operations, know office procedures, and be able to reproduce maps. His duties would be:

a. Keeping the center's fire operations map currently posted.

b. Maintaining backup information for the display equipment in the fire dispatch center.

c. Reproducing copies of maps and reports when required.

d. Maintaining fire administrative records as necessary.

e. Organizing and supervising subordinate personnel.

5. Equipment and Supply Officer. The equipment and supply officer is responsible to the resource chief for obtaining and distributing all items called for in the fire operations of the Emergency Operating Center. He should be knowledgeable in the equipment and supply requirements of large fires and means of transportation. His duties would be:

a. Keeping the resource chief informed on sources from which major fire control and rescue equipment and supplies can be obtained.

b. Maintaining a current record of resources of equipment and supplies which are vital to the EOC fire operations.

c. Checking equipment and supply orders approved by the fire operations chief for completeness; determining the need for supplementary items.

d. Determining the type of transportation equipment needed and arranging for it through the dispatch chief.

e. Placing all orders for equipment and supplies with the dispatch chief.

f. Organizing and supervising subordinate personnel.

6. Air Officer. The air officer is responsible to the resource chief for arrangements of all types of aircraft used or directed from the Emergency Operating Center. He should be a qualified airman and know the capabilities and limitations of the aircraft employed. In addition he should be sufficiently familiar with fire control operations to relate the aircraft to fire control needs. His duties would be:

   a. Arranging for the availability, operation, and maintenance of aircraft needed under direct control of the EOC.

   b. Arranging air transportation for manpower, equipment, and supplies, as required.

   c. Arranging for aerial reconnaissance as required by the intelligence officer.

   d. Supervising airmen and the air operations directly attached to the EOC.

RESPONSIBILITIES FOR FIRE DEFENSE

The responsibility for planning, coordinating, and directing fire defense at the national level is assigned by the President to the Secre-

tary of Defense, the Secretary of Agriculture, and the Office of Emergency Planning. The Secretary of Defense, who has major national level responsibilities for Civil Defense, has delegated these responsibilities, including fire defense in urban areas, to the Secretary of the Army, who in turn has assigned them to the Office of Civil Defense. The Secretary of Agriculture, who has responsibility for fire defense in rural areas, has assigned this responsibility to the Forest Service. The Office of Emergency Planning advises and assists the President in planning, and coordinating fire defense. More specific definitions of these and other responsibilities follow.

INDIVIDUALS AND FAMILIES

Individuals and families should be prepared for:

1. Applying the basic rules of fire prevention.
2. Reporting fires.
3. Extinguishing small fires.
4. Implementing special protective measures.

INDUSTRIES AND OTHER ORGANIZATIONS

Industries and other organizations should be capable of:

1. Self-protection against fires.
2. Applying prevention measures to protect themselves and their communities.
3. Training key employees to perform fire defense tasks.

4. Designing, producing, and marketing equipment which can be used for fire defense.

LOCAL GOVERNMENTS

Except for areas protected by the state and Federal governments, the county and municipal governments are the frontline executors of fire defense. This responsibility includes:

1. Analyzing the fire emergency needs, including the potential nuclear fire threat within their jurisdictions.
2. Preparing plans to meet emergency needs within their jurisdictions.
3. Implementing these plans to assure an adequate state of fire defense readiness.
4. Taking fire defense actions to save lives and vital resources during an emergency.
5. Coordinating the fire defense activities of their jurisdictions with neighboring jurisdictions and priorities established by intrastate zone and state level fire coordinators.

STATE GOVERNMENTS

The Federal government agencies, including OCD, advise, guide, and assist the states and their political subdivisions in civil defense, of which fire defense is an integral part. The state level is the primary coordinating level in fire defense except for Federal resource.

Governors assume control during emergencies and working with local governments, assign command of disaster areas, determine priorities and assist fire manpower and resources to disaster areas.

State governments are responsible for:

1. Assisting their counties and municipalities in developing a fire defense capability.
2. Preparing a state fire defense plan which clarifies the responsibilities, policies, and procedures for the state.
3. Coordinating fire defense within their jurisdiction, with other states, and with Federal agencies.
4. Enacting enabling legislation to facilitate fire defense.

THE OFFICE OF CIVIL DEFENSE

The Director of the Office of Civil Defense is responsible for directing and coordinating national fire defense for the Federal government including:

1. Preparing and maintaining a National Fire Defense Plan.
2. Assisting state and local governments in developing fire defense readiness.
3. Conducting necessary national level training for nuclear fire defense and providing assistance and guidance for similar training at the state and local level.
4. Guiding and coordinating fire defense activities of Federal

agencies including correlation of urban and rural fire defense through cooperation and working arrangements with the Secretary of Agriculture, who is responsible for preparedness and direction of fire defense in rural areas.

5. Providing necessary facilities and staffing at national and regional headquarters to give professional leadership and service to the fire defense program.
6. Providing state and local governments and other Federal agencies with the basic planning assumptions, information, systems, and methods necessary for effective fire defense.
7. Conducting a Federal research and development program to clarify the nuclear fire problem and to determine effective methods, materials, and facilities for the fire defense of the Nation.
8. Providing technical and financial assistance, including grants-in-aid, to the states and their political sub-divisions for personnel, emergency operating center facilities, equipment, training, and administrative expenses.
9. Developing and maintaining the support systems necessary for fire defense, including nuclear fire analysis and damage assessment capability.
10. Defining potential fire defense needs and claiming the personnel and resources needed at the zone and national level

for fire defense.

OFFICE OF EMERGENCY PLANNING

The Office of Emergency Planning is responsible for:

1. Assisting the President in coordinating the emergency preparedness activities of the Federal government.
2. Planning for the direction of governmental, economic and other activities as may be determined by the President.
3. Advising the President on the coordination of all mobilization activities, controlling activities under the Defense Production Act, and determining kinds and qualities of materials to be stockpiled.
4. Assisting states in arranging interstate compacts and reciprocal aid arrangements.
5. During wartime, establishing the Office of Defense Resources to perform overall central resource management functions.

DEPARTMENT OF AGRICULTURE

The Secretary of Agriculture, working with the Department of Defense is responsible for developing plans for a National Rural Fire Defense Program and directing fire defense activities in rural areas of the United States.

The Secretary of Agriculture has assigned the Forest Service to carry

out the following responsibilities:

1. Advising and assisting the OCD in maintaining the rural aspects of national fire defense including joint pre-emergency planning between rural and urban fire services and provisions for fire mutual aid between these services as needed during emergencies.
2. Assisting state governments in developing fire defense for rural areas.
3. Conducting research and development in support of the rural fire defense mission.
4. Conducting, in cooperation with OCD, the rural aspects of national fire defense, training, and providing assistance and guidance for rural area training at the state and local level.
5. Providing technical assistance to the states for fire defense planning and training in rural areas.
6. Defining rural area potential fire defense needs and transmitting these to OCD to be included in their claim for personnel and resources required for fire defense of the Nation.
7. Providing fire defense for all lands within the protection boundaries of the National Forests and National Grasslands.

MILITARY SUPPORT OF FIRE DEFENSE

When possible, the armed forces will render support to state or local authorities during a war-caused emergency. Fire protection and rescue may be included. This support is limited to resources not required for offensive or defensive military operations.

The Department of the Army has primary responsibility for military support of civil defense in the United States. They will develop and maintain plans and capabilities to assist civilian authorities in time of emergency, including coordinating military defense with civil defense and providing such military guidance, consistent with requirements for military security.

Of specific significance to fire defense are the Air Force's responsibilities to:

1. Furnish appropriate assistance to units of the Civil Air Patrol engaged in emergency civil defense missions.
2. Conduct post-attack aerial photo reconnaissance missions for bomb damage assessment purposes.

This information shall be made available to civil defense authorities as quickly as possible, in accordance with standing arrangements and procedures.

(See Federal Civil Defense Guide, Part A, Chapter 2, Attachment B)

OTHER FEDERAL AGENCIES

The Department of Interior provides fire defense for all rural lands under its jurisdiction and, as coordinated by the Department of Agriculture, will function in the fire defense program. Other Federal agencies will participate in applicable programs of national, state, or local fire defense plans.

PLANNING FOR FIRE DEFENSE

Preparing for fire defense in wartime requires developing capabilities at the local level to cope with nuclear fire, plus arrangements to receive intelligence, identify priorities, and coordinate emergency fire operations at the state, regional, and national levels. The incidence of fire from nuclear attack can be substantially reduced by measures taken prior to an attack. Organized fire suppression and rescue activities during and following an attack are vulnerable to the effects of blast and radioactive fallout. Action by the citizens to implement prevention measures and aid in suppressing fires will be necessary and can be helpful if the citizens are informed and trained. These requirements should be considered in fire defense planning at all levels.

Existing peacetime fire control capability is our Nation's most fundamental strength for fire defense in nuclear war. However, the fire problem that could develop from a nuclear attack demands additional extraordinary preparations and operations. The purposes of fire

defense plans are to:

1. Achieve readiness to apply the necessary extraordinary preparations and operations should an attack occur.
2. Provide means to join fire services and trained citizens to reduce the threat of nuclear fire in urban and rural areas throughout the United States.

Because the nuclear fire threat and resultant fire defense problem varies widely between communities in the United States, local fire defense requirements should be determined by a nuclear fire analysis. These analyses will help to identify the nuclear fire threat, inventory the communities' present capability to cope with the threat, and examine the potential effectiveness of protection measures the community might apply. Results of the analyses provide the basis for the community's fire defense plan. Methods and procedures for conducting nuclear fire analysis are in Appendix 1.

While local plans will vary as to content and organization, the objectives and planned actions of fire defense plans at all levels should complement one another. Thus, coordination will be possible and duplication minimized. Local strength and autonomy will be enhanced and at the same time a means provided to join all capabilities in a common defense from nuclear fire.

REGIONAL, STATE, AND LOCAL FIRE DEFENSE PLANS

Plans required for fire defense and the participating agencies are shown in Figure 5.

DURING AND POST-ATTACK OPERATIONS

To reduce fire threat to acceptable limits during and following an attack would require joint citizen-fire service - and sometimes military efforts. Existing paid and volunteer fire services should lead this effort and implement the necessary fire suppression and associated rescue activities. Their effectiveness depends on a high degree of planning, direction, communication, and coordination. It is extremely important that this capability be developed through the support activities and training described in Appendices to this Chapter.

STATE AND LOCAL ACTIONS

State and local governments should:

1. Analyze the potential nuclear fire problems in their jurisdictions.
2. Develop plans and capability necessary for successful defense from potential nuclear fire.
3. Be guided by the Appendices to this Chapter in their analyses, planning, capability development, and emergency operations.

Figure 5

PLANS REQUIRED FOR FIRE DEFENSE

Primary Organizations with Leadership Responsibility	Plans Required	
DOD USDA OEP USDI Other Federal Agencies	National Fire Defense	All tied together by enabling legislation, mutual aid pacts, training, and communications.
OCD Regions Forest Service Regions OEP Regions USDI Regions	OCD Regional Fire Defense	
State Governments National Forests USDI Field Units	State Fire Defense	
County Governments Forest Ranger Districts	County or Area Fire Defense	
City Governments	City Fire Defense	
Small Town & Community Governments	Community Fire Defense or Combined with other Local Governments	

APPENDICES

Appendices giving guidance for implementing this Chapter will include:

1. Nuclear Fire Analysis System

   Provides the instructions and methods for gathering and evaluating the data necessary for successfully planning fire defense.

2. National Fire Defense Plan

   Provide procedures, methods, and guidance for coordinated fire defense planning and action between national, regional, state, and local levels of government.

3. Fire Defense Training

   Provide guidelines and instructions for conducting the training necessary for successful fire defense.

APPENDIX B

(DRAFT)

NUCLEAR FIRE ANALYSIS SYSTEM

APPENDIX 1 TO PART E, CHAPTER 10

(A Draft of the Proposed Appendix 1)

FEDERAL CIVIL DEFENSE GUIDE

PART E, CHAPTER 10, APPENDIX 1

NUCLEAR FIRE ANALYSIS SYSTEM

March 1966

DEPARTMENT OF DEFENSE
OFFICE OF CIVIL DEFENSE

(This exhibit is written for long-term guidance. Changes necessary for interim guidance are indicated by footnotes.)

CONTENTS

FIGURES

INTRODUCTION AND OBJECTIVES

The Nuclear Fire Analysis System provides standard methods and instructions for analyzing the threat from nuclear fire. Applied nationwide, this system will develop data for fire defense plans, provide a base in OCD for analysis services, and enhance damage estimation if an attack should occur. Each community or area[1] is unique: the potential threat from nuclear attack would be different, governments and public services are organized differently, and there are other variations such as fire potential, terrain, water supply, population density, and road networks. Though fire defense may differ, the procedures and methods used for inventory, analysis, assessment and reporting can be the same.

Objectives of the Nuclear Fire Analysis System are to provide uniform methods and procedures to:

1. Examine and analyze the nuclear fire threat for each area.
2. Inventory the capability available to cope with the fire threat within each area.
3. Evaluate the effectiveness of alternative protective measures.

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[1] Geographical areas within which integrated Fire Defense Planning is required; i.e. a city, rural community, county, other political sub-division or a combination of these that might be encompassed by a potential nuclear disaster.

4. Establish the basis for a fire defense plan for each area, utilizing steps 1, 2 and 3 above.
5. Store basic data in a central data bank for use in planning, estimating potential damage from fire, and making strategic decisions during emergencies.

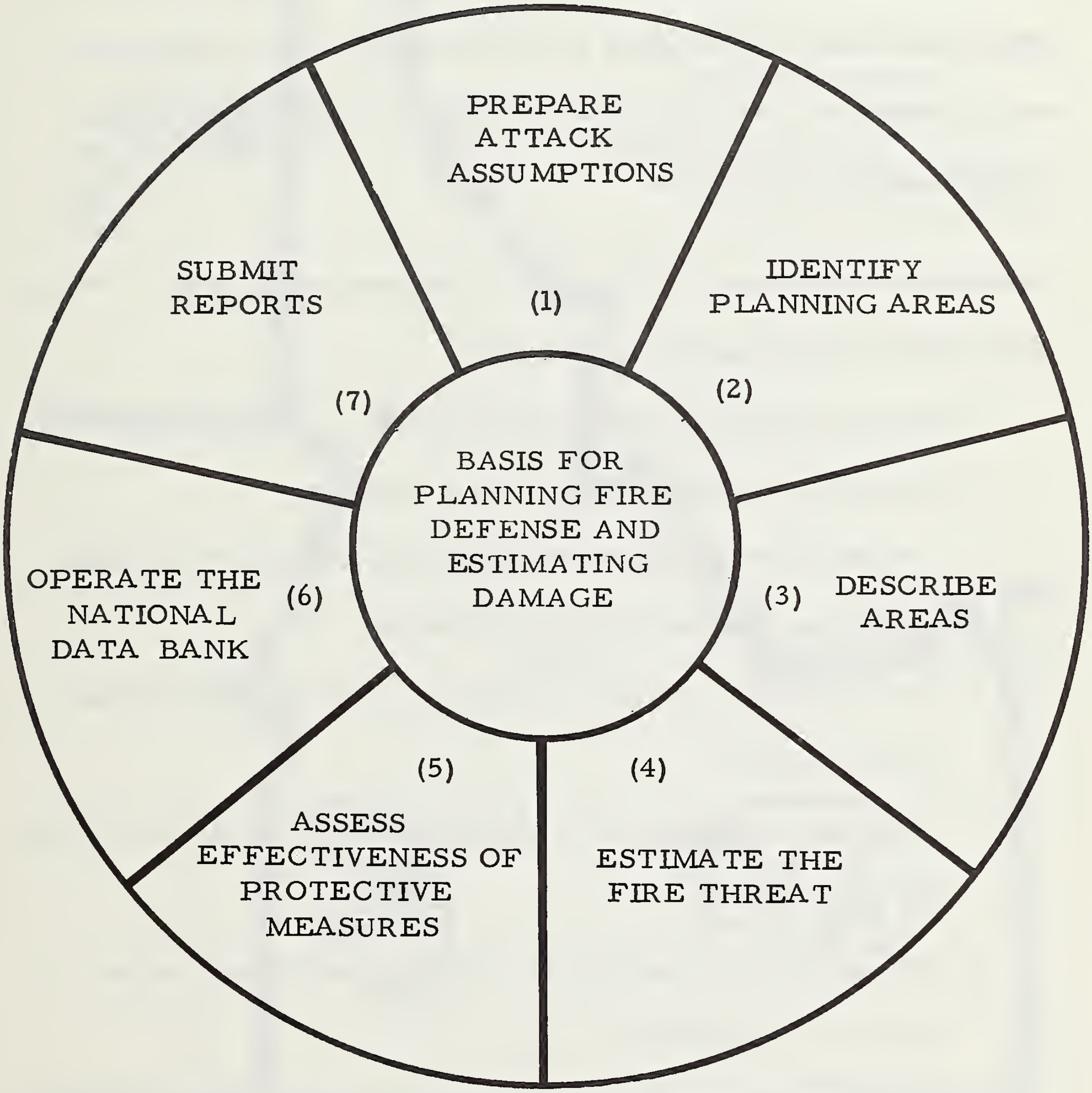
Major components of the Nuclear Fire Analysis System are shown in Figure 1.

ATTACK ASSUMPTIONS

Analyzing the potential fire threat to each community requires an estimation of how the community would be affected by blast, fallout, and fire in the event of an attack. Part A, Chapter 1, Federal CD Guide contains broad guidance on the potential exposure of the United States to blast and fallout damage from a heavy nuclear attack. Potential exposure to fire is not included because the nature of the fire threat varies with community conditions. For nuclear fire analysis purposes, attack patterns should be identified for each area. Upon request, the Office of Civil Defense will furnish attack patterns and characteristics for each state. These hypothetical attacks can then be analyzed with state and local fuels, weather, and topography to determine the potential threat from nuclear fire. However, the hypothetical attacks are only probability estimates, and flexibility must be arranged to cope with fire from varied attacks.

Figure 1

STEPS IN THE NUCLEAR FIRE ANALYSIS SYSTEM



IDENTIFYING THE PLANNING AREA

The first step is to locate groups of ground zeros on the attack map that could create areas of disaster requiring united command and coordination. Boundaries should be drawn to encompass the blast and thermal flash area and the adjacent political subdivisions required to furnish mutual aid. The areas are then identified where blast and primary ignitions[1] are apt to occur. Figure 2 is a sample of this process applied to one state.

Boundaries should also be identified for the remaining areas. When establishing these boundaries, consider:

1. Fire problems common to peacetime.
2. Existing arrangements for fire protection.
3. The probable presence of radioactive fallout and its effect on normal fire suppression activities.
4. The probability of need to help areas stricken by blast and thermal flash.
5. The need for mutual aid between political jurisdictions within the area.
6. The existence of natural fire breaks that would stop the spread of large fires.

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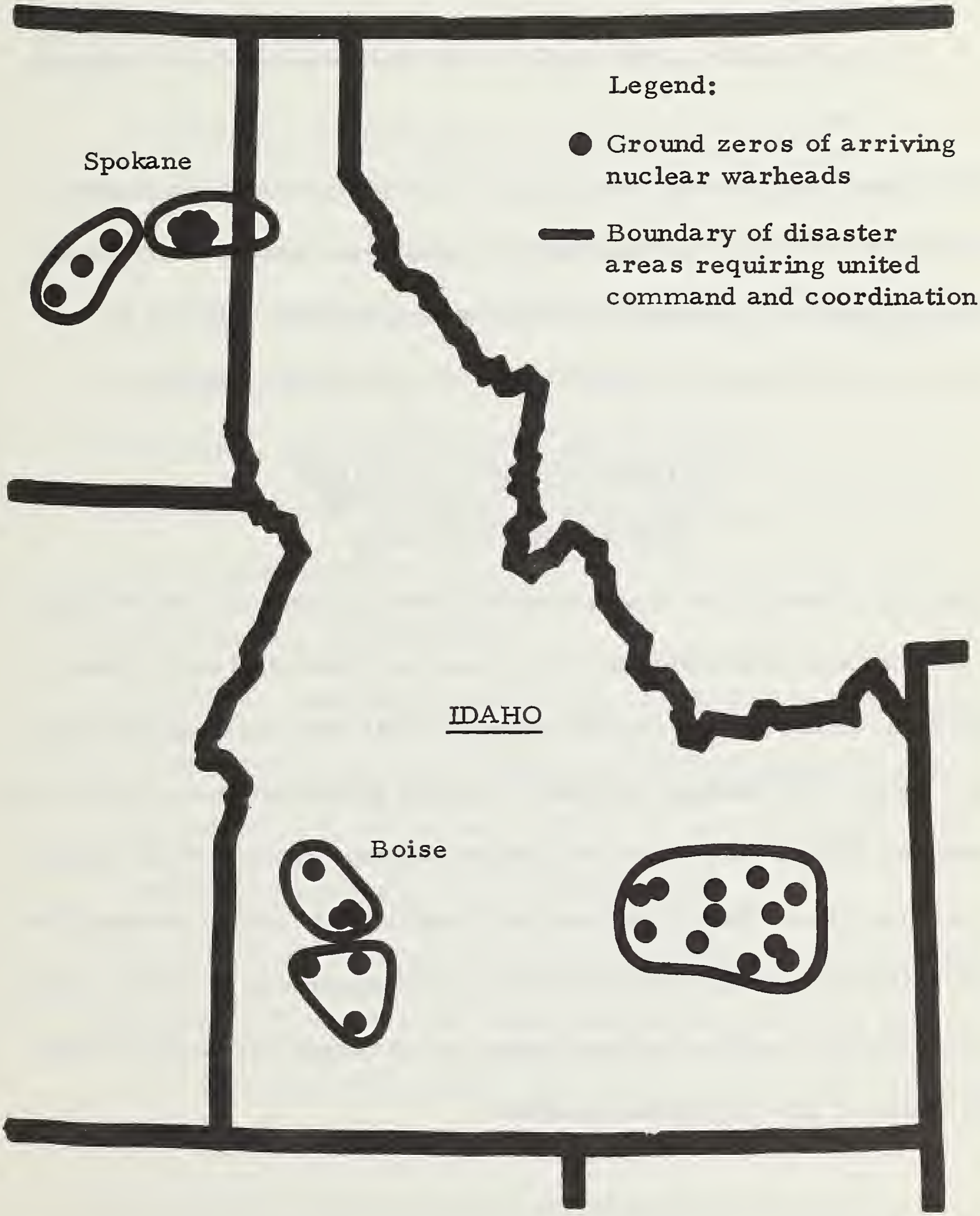
[1] Ignitions resulting from exposure of combustible fuels to the thermal flash.

Figure 2

SAMPLE NUCLEAR FIRE DISASTER AREAS



7. Continuity of fuels capable of carrying fire from rural to urban areas and vice versa.
8. Boundaries of political jurisdictions and fire protection districts.
9. Emergency water supplies and other means of fire suppression.

Since potential target areas may encompass several political subdivisions or fire protection districts, guidance from the state level should identify the potential target areas within and adjacent to the state and coordinate the nuclear fire analysis within each area.

COLLECTING INFORMATION

DESCRIBING THE AREA

Though planning areas may encompass several political subdivisions, each political subdivision or fire protection district should collect information describing the fire aspects of its own area, analyze the fire threat, and identify the most effective protective measures. The results of these efforts can be brought together for the whole area in a master plan. This procedure will facilitate the use of existing fire information since most inventories of fire equipment, records of fire vulnerability, and fire defense plans are arranged for political subdivisions or fire protection districts.

Collecting information is the most fundamental step of the Nuclear Fire Analysis System. This step establishes the base for the accuracy of fire threat predictions, assessment of protective measures, and estimates of damage from fire.

TYPES OF INFORMATION TO BE COLLECTED

Information describing the fire vulnerability and resources of a planning area should include such items as:

1. Urban and rural fuels by spread classification and ignition potential.
2. Location and size of fire-breaks or barriers.
3. Description of weather patterns typically experienced at various times of the year.
4. Description of topography.
5. Location, capacity, and fire susceptibility of fallout shelters.
6. Location of resources critical for survival and recovery.
7. A summary of the names, addresses, and qualifications of personnel with key roles in fire defense.
8. Location of radiological monitoring equipment and capability.
9. Location of private and governmental organizations able to aid fire and rescue activities in an emergency and a summary of their capabilities.
10. Location of key command and communications posts.

11. Location of water-supply sources.

12. Location of fire stations.

13. Amount, kind, and location of fire control equipment and supplies.

14. Roads, airports, waterways and similar access to isolated areas having fire ignition and spread potential.

RECORDING THE INFORMATION

Items 1, 2, 3, and 4 above are the basic factors that determine fire ignition, fire spread and subsequent fire threat to lives and resources. Items 1, 2, and 4 should be displayed on a base map sufficiently scaled for detailed analysis. Item 3 should be on an overlay map. The scale should be the same as the maps used for damage assessment.

Items 5 and 6 contain the information necessary to estimate the potential fire threat to human lives and resources. Shelters and critical resources will usually be depicted on the basic maps used for assessing damage. If these maps are not available, then shelter locations and critical resources data should be plotted on a map for use in estimating damage from fire.

Items 7 through 14 contain the information necessary for: assessing the units ability to cope with an attack; fire defense planning; and

launching fire control action if an attack occurs. To the extent possible, these data should be plotted on a map of the same scale but separate from the basic map.

Detailed instructions and methods for collecting information describing the area are available in:

1. Nuclear Fire Analysis Handbook, Annex 1 of this Appendix.
2. Rural Fuel Classification Guide, Annex 2 of this Appendix.
3. Urban Fuel Classification Guide, Annex 3[1] of this Appendix.

ESTIMATING THE POTENTIAL THREAT

The potential threat from nuclear fire should be estimated for each planning area. These estimates provide the basis for assessing and choosing the most effective combination of protective measures for each area, and can then be summed up to identify the magnitude of the potential threat to a whole state. Procedures for estimating the potential threat from nuclear fire are given in the Nuclear Fire Analysis Handbook, Annex 1[2] of this appendix.

The basic map should be studied to identify areas where: primary and secondary ignitions are expected;[3] conflagrations might occur;

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[1]For interim guidance, add "to be written."

[2]For interim guidance, add "to be written."

[3]Ignitions occurring from all sources except thermal flash.

serious firespread is not likely; reliable firebreaks are present; and controlling the spread of fires is unusually difficult. Annexes 2 and 3 contain instructions for evaluating the potential spread of fire in rural fuels, and the ignition potential and spread of fire in urban fuels. The planner can then determine the fire threat to fallout shelters and important resources located in the area. Typical weather patterns which influence the spread of fire outside of buildings should be examined and their important variations between time of year and time of day noted.

By comparing the above information with the ground zeros of the attack map and by using idealized fire damage patterns, estimates can be made of the areas where primary and secondary ignitions are present and capable of creating serious fires. Ground zero, height of burst, and weapon yield must be considered, since these factors influence the zone and extent of ignitions.

An estimate is now available of the ignitions that could occur in the area following a nuclear attack. Fuel loadings and firebreaks are known. Typical weather patterns are displayed. Fallout shelters and key resources are plotted. How far, how fast, in what direction will the fires spread? At this point the planner must bring into use his

fuel classification guides, Annex[1] 1 or 2, and the typical weather patterns for the planning area. Using these guides and data, and considering the topography and firebreaks shown on the planning maps, an estimate of firespread by periods of time can be made. It may be necessary to estimate the potential firespread under varying weather conditions. The timing and extent of firespread should be calculated to the point where a spreading fire would be stopped by some natural or man-made barrier or until it spreads into an area where no human lives or critical resources are threatened.

Consideration of radioactive fallout and blast damage is done by plotting the fallout and blast data for the hypothetical attack on the planning map. With the primary damage causing agents-blast, fallout and fire - recorded on the map we can identify the shelters and critical resources surviving after blast, the restraints created by radioactive fallout, and the threat from fire that would occur if no fire protective measures are undertaken. (Instructions in the Nuclear Fire Analysis Handbook, Annex 1, explains how to extend the above analysis to estimate number of casualties from blast and fallout and numbers of lives exposed to fire risk.[2]

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[1] For interim guidance, add "to be written."

[2] For interim guidance, add "when written."

The initial assessment of the fire threat should assume that no protective measures are in effect. The resultant threat posed in the uncontrolled fire situation forms the basis for assessing the effectiveness of protection measures under consideration. Thus, when a protective measure capable of reducing the fire threat is hypothetically employed, and a new fire damage estimate made, the improvement from the uncontrolled situation can be seen. In this way the relative effectiveness of alternative protective measures can be assessed in terms of persons removed from fire risk and resources saved.

ASSESSING THE EFFECTIVENESS OF PROTECTIVE MEASURES

Costs and effectiveness should be assessed first for those protective measures already available in the area. The most common available measures will be organized fire suppression and related rescue activities, cleanup campaigns, and current fire prevention activities. These measures should be hypothetically employed under the same conditions of assumed attack and a new damage assessment made. The probable effectiveness of the capability for defense from nuclear fire that exists within the area is now evident.

If the new damage assessment shows reduction of threat to life and resources to acceptable limits, the existing capability can be considered adequate. Further analysis should be made to explore all

possibilities of further reducing damage at a reasonable cost. If the assessment shows that existing fire capability is not acceptable, the analyst must continue until he has discovered the combination of protective measures that will produce adequate results at tolerable costs.

The process of estimating the potential threat from nuclear fire will sometimes reveal desirable measures. For example; it might become obvious that blast damage would disrupt water mains, suggesting the need for auxiliary water supplies; several community shelters might be located in potential conflagration areas, suggesting special fire defense for them or a plan to move people quickly to safer areas; flammable wildland fuels might surround or be adjacent to key resources, suggesting firebreaks or conversion of ground cover to less flammable types; radioactive fallout might limit the effectiveness of organized fire suppression, suggesting that more reliance be placed on ignition and spread preventive measures. These and similar indicators should be considered by the analyst when he searches for feasible protective measures.

Protective measures, which have been listed and proven feasible, are described in Annex 6. Instructions are included for each measure to aid the analyst in assessing the effectiveness, costs, and in identifying conditions under which the measure would be feasible. Analysts will find a valuable source of protective measures and related

information in Annex 6.[1]

Procedures and methods for assessing the effectiveness and costs of protective measures are in the Nuclear Fire Analysis Handbook, Annex 1[2] of this Appendix.

THE NATIONAL FIRE DATA BANK

Selected fire data will be stored in a data bank maintained by the Office of Civil Defense. These data will be used to: provide a base for fire damage assessments nationwide; facilitate national level decisions during an attack; and to provide analysis services to state and regional fire defense planners.

Information on fuels, firebreaks, weather and topography will be stored in the data bank. This information should be reported to the Office of Civil Defense for each planning area. Procedures and forms for reporting are described in Annex 5,[3] Reporting for Data Bank Storage. After fire ignition and spread information is programed on the data bank computer for a given planning area, the Office of Civil Defense can furnish threat analysis services for the area.

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[1] For interim guidance, add "when written."

[2] For interim guidance, add "to be written."

[3] For interim guidance preface the paragraph with "when operational" and change Chapter discussion to future tense.

Additional[1] multi-purpose information available to fire analysts from the data bank are: shelter locations and capacity by standard location areas[2] in major cities, ---to be completed by OCD to include pertinent data presently stored in computers.

Information from the National Fire Data Bank will be available and useful for planning the nationwide aspects of the fire defense program. This information will be especially useful at the national level for estimating nationwide fire effects during an enemy attack.

TIE-IN WITH FIRE DEFENSE PLANS

During the process of conducting a nuclear fire analysis for each planning area the analyst would: identify logical boundaries for the planning area; collect pertinent information describing the area; predict the potential fire threat from nuclear attack; examine present capabilities to cope with this threat; and identify feasible and effective extraordinary protective measures to be taken in his area. The information should be summarized in usable form. (See sample Nuclear Fire Analysis in Annex 4[3] of this appendix) Fire Defense plans should be prepared and executed as described in the Federal

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[1] For interim guidance change paragraph to future tense.

[2] An arbitrary subdivision of a city used for civil defense planning purposes.

[3] For interim guidance, add "to be written."

UPDATING THE NUCLEAR FIRE ANALYSIS

Urban areas are being rebuilt, industrial plants of varying fire susceptability are being built, plant cover in some rural areas is being modified, new fire threat countermeasures are being discovered, and attack strategies may change over periods of time. The Nuclear Fire Analysis for a given area must be updated when changing conditions create significant variation in the potential fire threat or the capabilities to cope with the threat.

Changes in factors encompassed by the Nuclear Fire Analysis will almost always affect fire defense plans for the respective area. Any significant changes should be thoroughly analyzed, a new planning base established and the fire defense plan updated.

ANNEXES

Annexes[1] to this appendix are:

Annex 1, Nuclear Fire Analysis Handbook.--A handbook containing methods and instructions for conducting a Nuclear Fire Analysis. (to be written)

Annex 2, Reporting for Data Bank Storage.--Instructions and forms for reporting local, state, and regional data to the national data bank. (to be written)

Annex 3, Protective Measures.--Describes feasible protective measures that should be considered by local governments for fire defense planning. (to be written)

Annex 4, Urban Fuel Evaluation Guide.--Instructions for rating ignition potential, firespread, and resistance to control of fuels in urban areas. (to be written)

Annex 5, Rural Fuel Evaluation Guide.--Instructions for rating ignition, potential, firespread, and resistance to control of fuels in rural areas. (to be written)

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[1] For interim guidance, add "to be written."

APPENDIX C

(DRAFT)

NATIONAL FIRE DEFENSE PLAN

APPENDIX 2 TO PART E, CHAPTER 10

(A Draft of the Proposed Appendix 2)

FEDERAL CIVIL DEFENSE GUIDE

PART E, CHAPTER 10, APPENDIX 2

NATIONAL FIRE DEFENSE PLAN

March 1966

DEPARTMENT OF DEFENSE
OFFICE OF CIVIL DEFENSE

(Subject to approval by OCD and coordination with participating agencies, this exhibit will serve for interim and long-term guidance. Changes necessary for interim guidance are indicated by footnotes.)

CONTENTS

FIGURES

INTRODUCTION

Successful civil defense in wartime requires pre-attack measures plus selective fire suppression action during and following an attack. This plan provides instructions for necessary fire prevention and coordination of fire control efforts on a nationwide scale.

The National Fire Defense Plan recognizes the responsibilities of individuals, industries, counties, municipalities, states, and the Federal government in prevention and control of fires in peacetime. During wartime the responsibility of these fire services will be to activate necessary extraordinary fire protective measures and take independent action to suppress fires with available resources.

Centralized coordination will be achieved by mutual agreement between the area coordinator, (county, city, state, regional, or Federal depending on the magnitude of the situation) the responding unit, and the unit requesting help. In arranging help to stricken communities, no fire defense unit should be depleted to the extent that protection of essential facilities for which they are responsible will be unduly jeopardized. The intent is to save all possible lives and key resources in beleaguered communities by arranging firefighting aid from more fortunate communities.

DEFINITIONS

Definitions in Part E, Chapter 10, Fire Defense, of the Federal Civil Defense Guide apply to this plan. Additional definitions follow:

1. Local Areas

   County, city, fire protection district, or combination of these established for tactical fire defense planning.

2. Extraordinary Measures

   Protective measures, support activities, and training required for fire defense, in addition to normal peacetime fire control activities.

3. Zone

   Intra-state zones established for fire defense planning and coordination.

NATIONWIDE FIRE DEFENSE ORGANIZATION

Table 1 of Part E, Chapter 10, Fire Defense, Federal Civil Defense Guide shows the nationwide organization for fire defense. The organization places reliance on locally situated fire services to prevent and suppress fires associated with nuclear attack, aided where needed by related government services, trained citizens, and available facilities of Federal, state, and local governments. The plan is to adjust normal peacetime fire activities to accommodate the extraordinary measures required to cope with nuclear fire.

The organization provides fire coordinators for intra-state zones, states, OCD regions, and the National Headquarters of the Office of Civil Defense. During peacetime these coordinators would:

1. Give fire defense technical support to fire services.
2. Arrange fire defense training.
3. Maintain fire defense plans for their areas.
4. Define the potential nuclear fire threat.
5. Guide the preparation of Nuclear Fire Analyses.
6. Maintain inventories of the capabilities of the fire services in their areas.
7. As required, coordinate fire control resources in peacetime disasters.

During wartime the coordinators would assess the relative severity of the fire situation in their areas and arrange aid to fire disaster areas where local fire forces were unable to cope with the situation.

In the event of a fire disaster, local fire control resources, including industrial brigades and other trained citizens, are to be utilized before help is requested. When additional manpower and equipment is needed for a city or county, or when a fire encompasses multiple jurisdictions, aid and guidance should be requested from the zone fire coordinator. If the joint capabilities of the zone are inadequate, the coordinator will request aid from the state fire coordinator. This

procedure extends through the OEP-OCD regions to the national level if necessary.

The intent is to rely heavily on the capability of local units, providing coordination and aid only when the local unit is clearly unable to cope with the fire situation and requests help. Help will be arranged by mutual agreement between the requesting unit, the fire coordinators and the sending unit. During severe fire situations where several jurisdictions are involved simultaneously, it is advisable to establish a team made up of liaison from affected fire services, to help the fire coordinator.

LOCAL FIRE DEFENSE OPERATIONS (COUNTY, CITY, OR OTHER TACTICAL PLANNING AREA)

RESPONSIBILITIES

Local governments are the front-line executors of fire defense. A Fire Defense Coordinator should be assigned to the local civil defense director to coordinate fire defense readiness and emergency operations. The local governments' specific responsibilities for fire defense are described in the parent Chapter, Part E, Chapter 10, Federal Civil Defense Guide.

AUTHORITY

The laws of the state should charge the county or city Fire Defense Coordinator with the preparation and administration of his area's fire

defense readiness programs and with coordination of fire defense operations within his area of jurisdiction during wartime emergencies.

OBJECTIVES

Brief local fire defense plans should be prepared with the guidance necessary to activate the fire defense organization if an attack occurs. Data developed during the Nuclear Fire Analysis should be the basis for all local plans. See Appendix 1. The objectives of local fire defense plans are to:

1. Set forth the authorities and responsibilities of key participants in the plan.
2. Identify the protective measures, and procedures for implementing them during times of tension.
3. Set forth the on-site operational activities to be implemented if a fire defense emergency occurs.
4. Provide maps and inventories necessary to make effective decisions and take effective action.
5. Identify priorities to be considered in a fire disaster.
6. Provide mutual aid and command arrangements necessary for effective fire defense.
7. Provide the intelligence and communications necessary to make timely and effective decisions and take action to save maximum lives and resources from fire.

8. Provide for training personnel as necessary to cope with the potential local fire threat.

9. Provide for radiological monitoring services to be a part of or accompany fire control operations.

ORGANIZATION

The local fire defense organization must achieve preparedness to reduce the threat from nuclear fire to the community, direct firefighting operations, protect people in fallout shelters, and to accomplish this within the constraints imposed by radioactive fallout.

Since fire problems differ greatly between communities, each local area needs a fire defense organization that is similar between communities to allow effective mutual aid operations yet is tailored to the unique problem of each area. The local fire defense organization should be an extension of the existing peacetime fire organization.

Local Fire Defense Coordinator

An outstanding fire official and alternates should be assigned to serve as Fire Defense Coordinator for the local area. He works with the administrators of the local governments and the civil defense director to coordinate fire defense readiness and emergency operations throughout the local area. If desired, an Advisory Committee made up of representatives of the areas fire services, local governments,

and others should be appointed to advise and guide him.

Local Emergency Operating Center

Local fire defense organization should provide for the Fire Defense Coordinator, plus necessary fire staff, to be situated at the local civil defense Emergency Operating Center during the emergency. If an Emergency Operating Center has not been designated, the administrators of local governments, the civil defense director, and the fire defense coordinator should agree upon and designate a location from which fire defense would be coordinated during an emergency. See Fire Staffing for the Emergency Operating Center, Federal Civil Defense Guide, Part E, Chapter 10, Fire Defense.

STATE FIRE DEFENSE OPERATIONS

RESPONSIBILITIES

State governments are responsible for assisting their counties, cities, and rural protection districts in developing capability for fire defense; for coordinating fire defense planning within their jurisdictions, with other states and with the Federal government; and for making firefighting resources available to their political subdivisions and, when possible, to other states. See Fire Defense Responsibilities for Local Governments in Part E, Chapter 10, Federal Civil Defense Guide.

AUTHORITY

The sovereign authority of the states, as expressed in their constitutions and various emergency statutory authorities, provide the basis upon which the state governments and their political subdivisions direct and coordinate civil defense activities. All states have statutory enactments concerning civil defense. Most states have generally followed the model state Civil Defense Act endorsed by the Council of State Governments.

OBJECTIVES

The state's objectives in fire defense are to exercise supervision of the organization, planning, equipping, training, and operations of fire defense statewide. The state is the primary coordinating level during wartime emergency operations. A State Fire Defense Plan should guide readiness activities and fire defense emergency operations in the state. Objectives of State Fire Defense Plans should be to:

1. Coordinate fire operational activities in emergencies based on priorities within the state.
2. Maintain an adequate reserve of fire command and staff personnel to meet emergencies within the state.
3. Set forth the fire defense responsibilities, policies, and procedures for the state as a whole.

4. Assemble the fire damage and intelligence data necessary to determine priorities within the state during emergencies.
5. Transmit state intelligence data to regional headquarters.
6. Arrange intra-regional and inter-state mutual aid when local capabilities become over-taxed.
7. Activate protection measures within the state during times of international tension.
8. Describe the emergency duties, responsibilities and authorities of key members of the state fire defense organization.
9. Set forth the fire defense organization for the state and describe the duties and responsibilities of key people, and the conditions under which the fire defense plan would be activated.
10. Provide drafts of the legislation necessary for effective mutual aid.
11. Provide for radiological monitoring services for fire defense operations, in the state.
12. Provide maps and inventories necessary to make effective decisions and take appropriate action at the state level.

ORGANIZATION

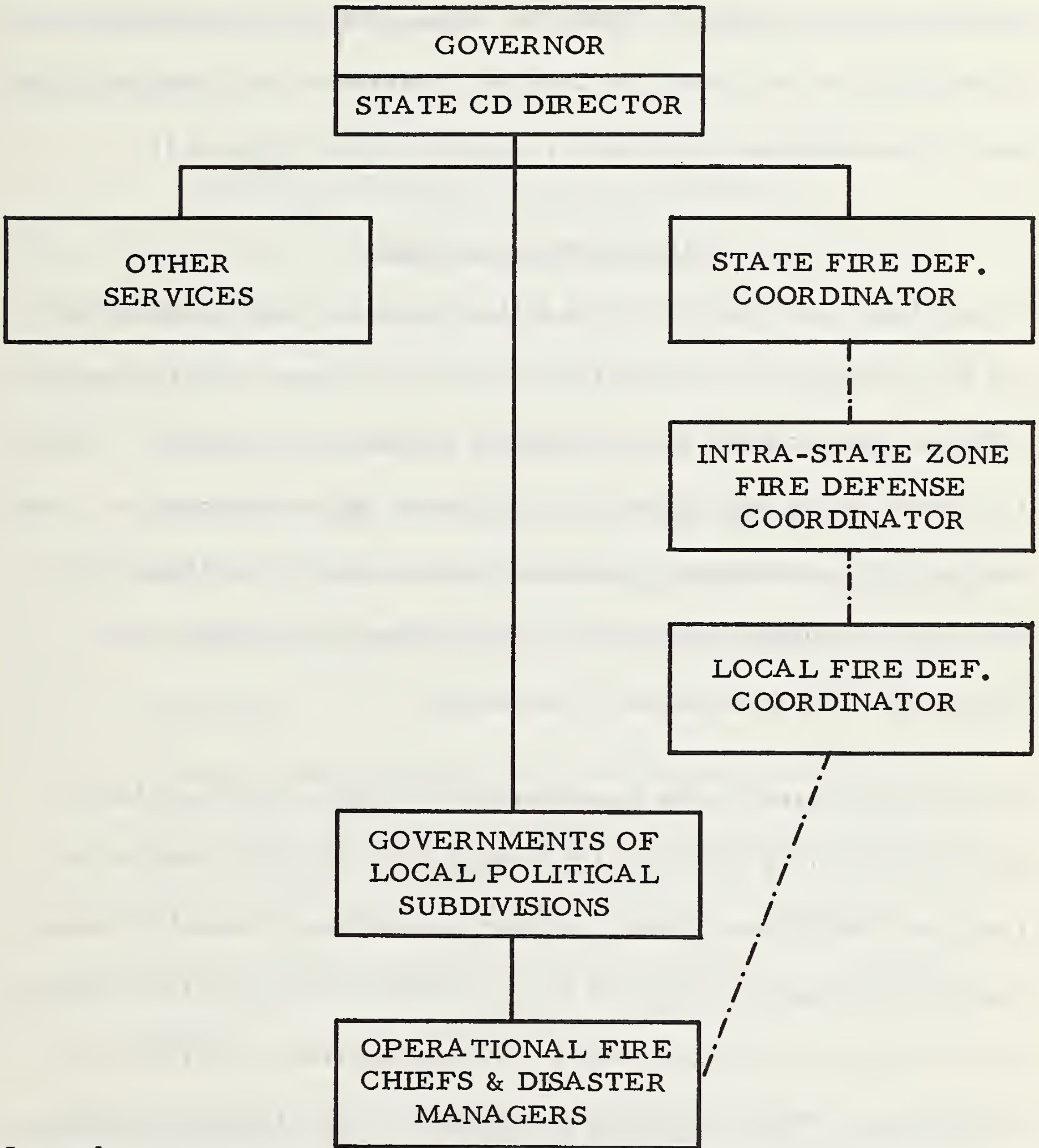
In most states, the Civil Defense Organization is under the supervision of a Director of Civil Defense. The Model Act provides that the Governor retain general direction and control over the Civil Defense Agency. He directs the performance of emergency functions within the regularly constituted government structure. The departments and agencies of the state are utilized by the Governor and the Civil Defense Director in carrying out the civil defense functions. In the event of disasters beyond local control, the Governor is authorized to assume direct operational control over all or any parts of the civil defense organizations of the state.

State Fire Defense Coordinator

The State Fire Defense Coordinator is usually the peacetime Chief of the Fire Services for the state. If not, a highly-qualified fire services officer should be appointed from one of the fire services in the state to act as coordinator. To assure occupancy of the position in an emergency, at least one alternate should be appointed and trained. The state fire coordinator's duties are to carry out the responsibilities and planning objectives described earlier. His organizational relationships to the state Governor, State Civil Defense Director, and other fire defense coordinators in the state are shown in Figure 1.

Figure 1

RECOMMENDED STATE FIRE DEFENSE ORGANIZATIONS



Legend:

—·—·—·—·—·— Coordination in readiness and emergency operations

———————— Civil defense direction vested in the Governor

Zone Fire Defense Coordinators

In states having heavy fire potential it will be necessary to establish fire defense zones and assign coordinators to coordinate readiness and emergency operations within the zones. These coordinators are counterparts of the State Fire Defense Coordinator with similar duties and responsibilities within their respective zones (Figure 1).

Fire Defense Command

Fire defense coordinators at the state, zone, and local levels would not have command responsibilities unless these powers were specifically assigned to them by the Governor during the emergency. Theirs is a coordinating role having as its objective the achievement of a high degree of pre-emergency readiness in their areas, identifying priorities and capabilities within their areas during emergencies, and arranging aid to beleaguered communities.

Command is vested in the operational fire chiefs at the local level, the administrators of political jurisdictions in the state, and in the Governor through emergency statutory authorities. Mutual aid agreements should specify who is to be in command, or means for deciding who is to be in command, when a fire encompasses more than one jurisdiction. When mutual aid agreements do not clarify command or if the fire is so large it transcends the mutual aid area, it may be necessary for the Governor to assign a fire commander.

As an alternative, he might choose to assign an overall disaster manager with line authority to assign a fire commander to his staff. Either way, a capable fire service officer should be sought for this extremely demanding assignment. See Figure 1 for lines of direction and coordination.

State Fire Defense Advisory Committee

A State Fire Defense Advisory Committee should be established to advise the State Fire Defense Coordinator. The duties of this committee would be:

1. Currently scrutinizes fire defense plans, programs, and operations and recommends improvements as necessary.
2. Advises the Fire Defense Coordinator on the organization, content, and procedures of the Fire Defense Program in the state.
3. Provides understanding and coordination of the Fire Defense Program among all of the fire services in the state.
4. Helps the State Fire Defense Coordinator during emergencies to identify priorities and arrange aid on a statewide basis.

The Fire Defense Advisory Committee should have authority to meet at times of their own choosing and should be expected to assemble upon request of the State Fire Defense Coordinator. Membership

recommended for this Committee includes a representative from each of the following services:

1. State Forest-Fire Service
2. Each Federal agency having a major fire responsibility in the state
3. Collective Rural or Volunteer Fire Departments
4. Municipal Fire Departments
5. Industrial Fire Departments
6. Fire Education Organizations

State Fire Defense Operating Center

Fire defense operations during a wartime emergency should center in the State Civil Defense Emergency Operating Center. The basic requirements for fire defense at the center are protection from radioactive fallout, effective communications, maps, inventories of manpower and equipment, and space necessary for the State Fire Coordinator and his staff to work effectively. Operating procedures should be established for each state Center that will meet the requirements of fire defense in the state, in harmony with the total Civil Defense effort. Fire staffing for emergency operating centers is explained in the parent Chapter, Federal Civil Defense Guide, Part E, Chapter 10, Fire Defense.

FIRE DEFENSE OPERATIONS - OCD REGIONS

RESPONSIBILITIES

Fire coordinators in OCD regions are responsible for coordinating fire defense readiness and emergency operations among the states within the region; arranging aid from outside the region when fire defense capabilities within the region are exhausted, providing technical advice to states and Federal agencies; screening grants in aid requests for fire defense; and, during emergencies, recommending fire defense actions that are beyond the capability of a state or states within the region.

AUTHORITY

Fire coordinators in the OCD Regions operate under the authority established by the Federal Civil Defense Act of 1950, as amended, which states in part:

> "It is the policy and intent of Congress to provide a system of civil defense for the protection of life and property in the United States from attack. It is further declared to be the policy and the intent of Congress that the responsibility for civil defense shall be vested jointly in the Federal Government and the several states and their political subdivisions. The Federal Government shall provide necessary direction, coordination, and guidance; ------ and shall provide necessary

assistance as herein authorized."

The President, in Executive Order 10952, delegated to the Secretary of Defense certain responsibilities for civil defense, including fire defense, which is shared with the Secretary of Agriculture. The Secretary of Defense has delegated the authorities contained in Executive Order 10952 to the Secretary of the Army who has redelegated them to the Director, Office of Civil Defense. This delegation provides the authority for Fire Defense Coordinators in the OCD Regions.

OBJECTIVES

OCD Regional objectives in fire defense are to achieve a high degree of readiness and flexibility within the region to cope with fires from nuclear attack. A regional fire defense plan should guide readiness activities and fire defense emergency operations in the region. Objectives of OCD regional fire defense plans should be to:

1. Coordinate fire operational activities in emergencies based on priorities within the region.
2. Assemble the fire damage and intelligence data during emergencies necessary to determine priorities within the region.
3. Transmit regional intelligence data to national headquarters.
4. Maintain a current record of fire prevention and suppression capability within the region.

5. Arrange inter-regional aid when the regions' capabilities become over-taxed.

6. Aid states and government agencies to activate protective measures during times of tension.

7. Arrange the regional level training necessary to achieve readiness, activate protective measures, and conduct emergency operations.

ORGANIZATION

The Fire Defense Coordinator for OCD Regions serves as the principal staff assistant for fire defense in the Office of the Regional Director of Civil Defense. He should be a highly-qualified fireman capable of understanding urban and rural fire problems and the relationships between them.

FIRE DEFENSE OPERATIONS -- NATIONAL HEADQUARTERS

RESPONSIBILITIES

Federal leadership for fire defense of the United States in wartime is shared by the Department of Defense and the Department of Agriculture. Fire defense in urban areas and overall coordination is with OCD-DOD; fire defense in rural areas is with the Forest Service, USDA.

The Department of Interior provides fire defense for lands under its jurisdiction and participates in the fire defense program as provided in National, regional, and state fire plans. Other Federal agencies are responsible for fire defense on lands under their respective jurisdictions. (See Federal Civil Defense Guide, Part E, Chapter 10, Responsibilities for Fire Defense).

AUTHORITY

Fire defense operations at National Headquarters are conducted under authority established by the Federal Civil Defense Act of 1950, as amended. Also emergency preparedness functions are assigned to government agencies by Presidential Executive Orders. Executive Orders most pertinent to fire defense are:

Executive Order 10952, July 20, 1961, as amended, assigning Civil Defense responsibilities to the Secretary of Defense and others.

Executive Order 10998, February 16, 1962, assigning emergency preparedness functions, including Rural Fire Defense, to the Secretary of Agriculture.

Executive Order 11051, September 27, 1962, Prescribing responsibilities of the Office of Emergency Planning.

The Federal Civil Defense Act and the above Executive Orders prescribe the basic Federal authorities for fire defense. Additional Executive Orders assign emergency preparedness to Federal agencies in support functions significant to fire control; for example, aircraft,

water, and motor fuel. (See Federal Civil Defense Guide, Part B, Chapter 1).

MISSION AND OBJECTIVES

The national fire defense mission is to achieve and maintain a state of readiness throughout the United States that will reduce losses from fire to acceptable limits, at tolerable costs, if an attack occurs. Operations at the National Headquarters are intended to:

1. Provide management direction and assistance to fire defense planning and action between National, regional, state, and local levels of government to achieve a unified total fire defense.
2. Provide the procedures, instructions, methods, and systems necessary to effectively implement the fire defense program.
3. Establish the organizational and operational basis for coordinating and utilizing fire control capabilities for fire defense of the U. S.
4. Claim the manpower, equipment, and materials necessary to carry out fire defense activities.

ORGANIZATION FOR READINESS OPERATIONS

The overall organization for fire defense is related to the Civil Defense organization and shown in Table 1, Chapter E-10, Federal Civil

Defense Guide. A more specific description of the organization for fire defense readiness operations at National Headquarters is shown in Figure 2.

Federal agencies - OCD, OEP, USFS, and others with fire defense responsibilities - utilize their normal organizational capabilities in preparing for fire defense.

National Fire Defense Coordinator

A National Fire Defense Coordinator operates under the direction of the Director of the Office of Civil Defense. He should be a highly-qualified fire professional capable of understanding, coordinating, and supporting the fire defense program for the United States. The peacetime duties of the coordinator and staff stress technical guidance, training, and support services including:

1. Maintenance of the National Fire Defense Plan.
2. Assistance to state and local governments.
3. National-level Nuclear Fire Leadership Training.
4. Correlation of Urban and Rural Fire Defense.
5. Support systems.
6. Claimance of personnel and resources.
7. Technical staff support to urban and rural fire services.

During wartime emergencies the coordinator would serve as the Executive Officer of the Fire Operations Group (described later) to

SUGGESTED ORGANIZATION FOR FIRE DEFENSE READINESS OPERATIONS
(NATIONAL LEVEL)

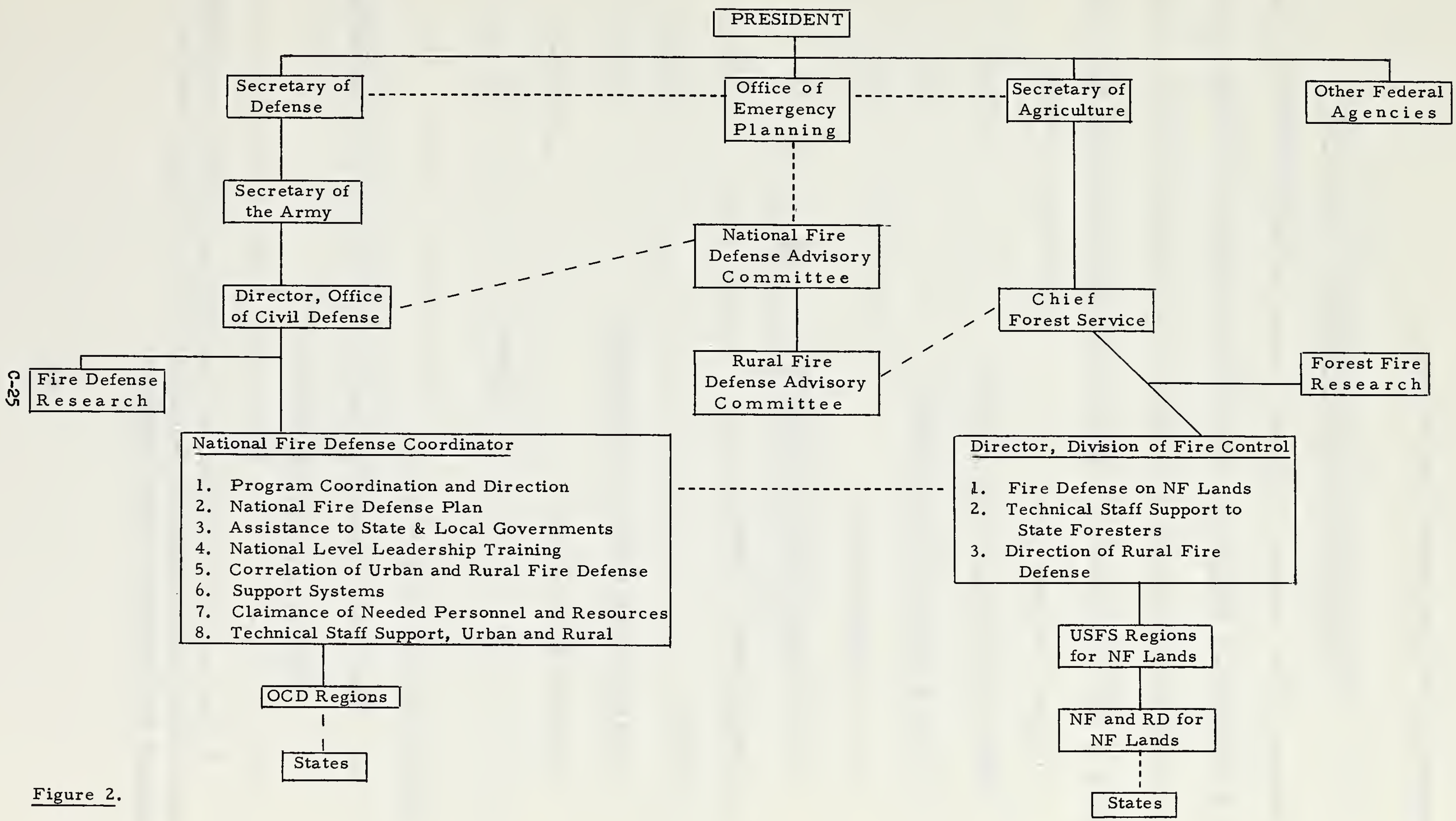


Figure 2.

Legend:

——— Direction

— — — — Advisory Services

-------- Coordination

coordinate National-level fire defense.

National Fire Defense Advisory Committee

A National Fire Defense Advisory Committee advises OCD on the over-all Fire Defense Program. Committee members are chosen by the participating organizations listed below and approved by the Director, Office of Civil Defense. Committee membership should be as follows:

Urban Fire Services	-3
*Fire Supporting Organizations	-4
Fire Education Organizations	-2
U. S. Forest Service	-1
Association of State Foresters	-1
Department of Interior	-1
OEP	-1
State Fire Marshal or coordinator	-1
Federal Fire Council	-1
Total	15

Duties of the Committee are to:

a. Serve as a sounding board and advisors for Fire Defense Program proposals of OCD.

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* National Fire Protection Association, American Insurance Association, International Association of Fire Chiefs, and International Association of Fire Fighters.

b. Currently scrutinize Fire Defense Programs, plans, and operations and makes recommendations for improvement as necessary.

c. Keep informed on the Fire Defense Program balance between the several government agencies involved and the states and advises OCD as necessary to maintain fire defense preparedness.

Every two years the committee will elect from its ranks a chairman, a secretary, and four additional members to form an executive board for carrying on routine business.

National Rural Fire Defense Committee

The National Rural Fire Defense Committee acts as a sub-committee of the National Fire Defense Advisory Committee (Figure 2). This committee is an Advisory Group to the Chief, Forest Service, to provide inter-agency coordination and advise the rural fire defense planning at the National level. It helps provide leadership and direction to the rural fire defense program. It is comprised of members and alternates of the Forest Service, Department of Interior, Association of State Foresters, Federal Extension Service, and a liaison representative of the Office of Civil Defense.

Fire Defense Operating Group

At the National Headquarters, a Fire Defense Operating Group is responsible for directing fire defense activities during an attack. The Operating Group's place in the overall fire defense organization can be seen in Figure 3.

The objectives of this group are to:

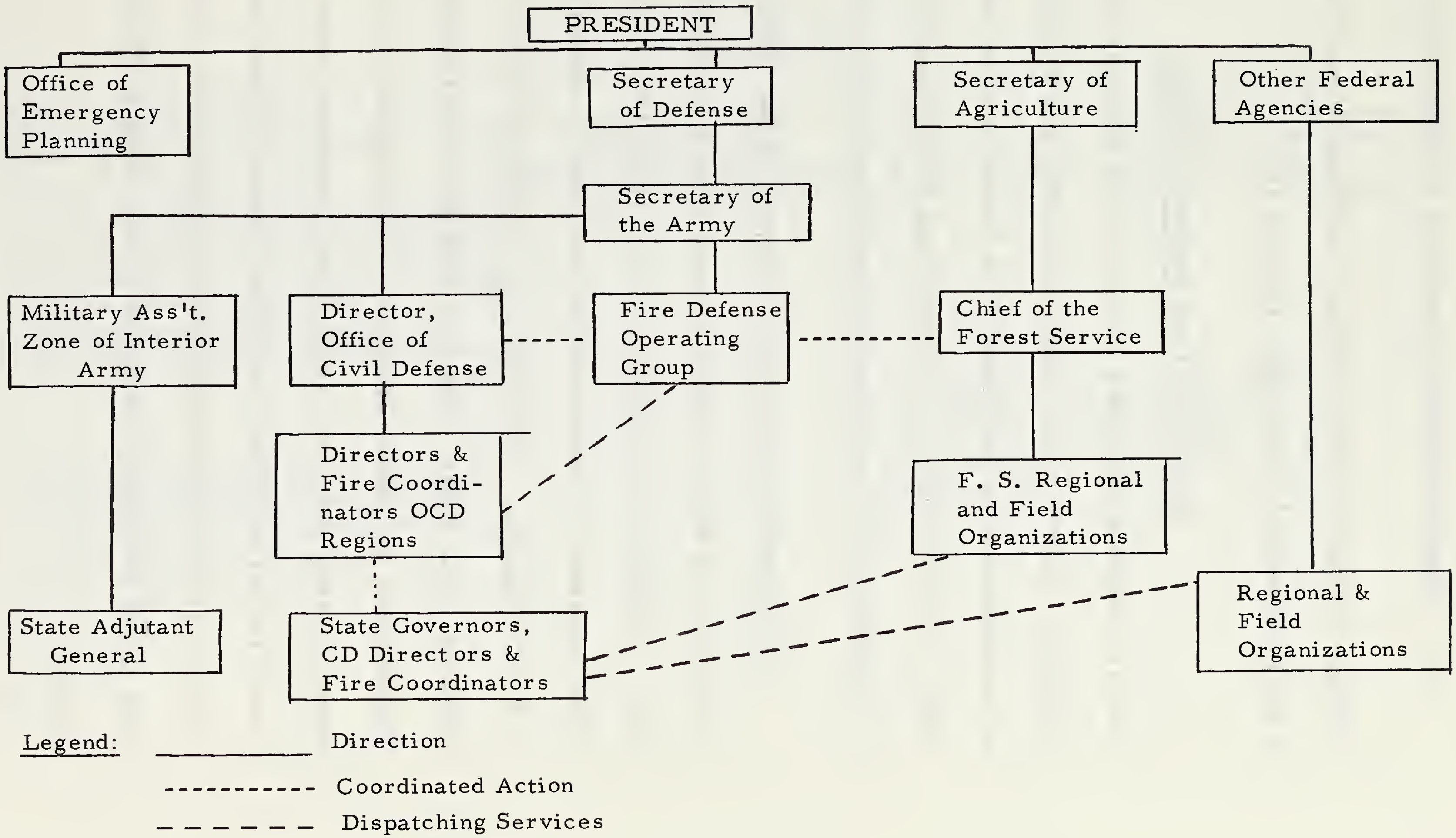
1. Provide fire situation analysis and recommendations to administrators.
2. Provide services to carry out decisions regarding fire and associated rescue.

Achieving these objectives requires the operating group to:

1. Analyze the existing and potential fire threat to urban and rural areas.
2. Estimate the amount of operable fire control resources remaining after the attack.
3. Advise the administrative group of national level decisions that will help cope with the fire threat, including consideration of priorities.
4. Advise the administrative group on the use and control of key fire control resources.

Figure 3

PROPOSED WARTIME ORGANIZATION FOR FIRE DEFENSE
(NATIONAL LEVEL)



5. Provide dispatching services to activate the decisions.

During an attack the Fire Defense Operating Group would be located at the National Relocation Site (Figure 4).

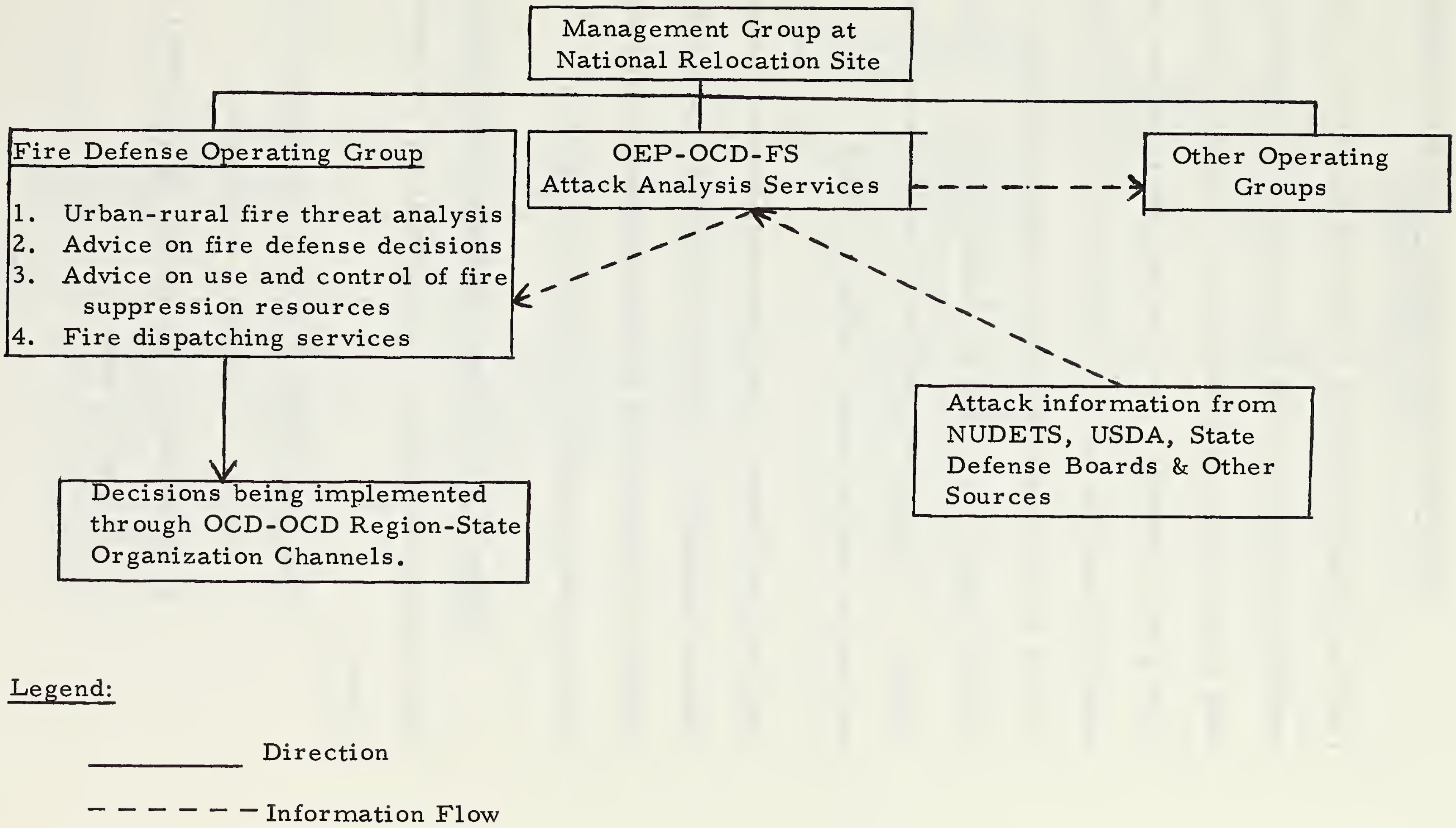
Authority of the Operating Group

The Fire Defense Operating Group will not make strategic fire defense decisions. They analyze intelligence data and recommend decisions for consideration by the Chief of the Forest Service and the Director, Office of Civil Defense. The Operating Group dispatches messages for commitment of personnel and equipment between regions.

Attack information will be analyzed by the Office of Civil Defense and the Forest Service and urban and rural fire damage assessments made. Additional data will flow to the relocation site through the USDA's system of defense boards and from the states through the OEP-OCD Regions. OCD will analyze the fire data for urban areas; USDA for rural areas. The data will then be forwarded to the FS-OCD Fire Defense Operating Group who will consider the combined fire threat to urban and rural areas, and recommend ways to deploy fire control resources within the United States. When a fire defense decision is made by the administrative group, the Fire Defense Operating Group will carry out the decision, using OCD-OEP Regional channels.

Figure 4

PROPOSED ORGANIZATION AND INFORMATION FLOW FOR FIRE DEFENSE
(NATIONAL RELOCATION SITE)



Organization and Staffing of the Fire Defense Operating Group

The Fire Defense Operating Group will be staffed by personnel who are qualified in urban and rural fire control. In addition, each member shall have specific qualifications in his specific staff assignment within the group. Individuals will be assigned to achieve balanced urban-rural fire control capabilities within the group. At least one alternate for each group member should be assigned and trained. Selection will be made jointly by OCD and the Forest Service. Alternates will be assigned. Training and practice drills will be conducted to qualify the group to work as a team during an attack.

The Executive Officer of the Operating Group will be the National Fire Defense Coordinator. A primary staff of five fire officers, plus the necessary specialists and clerical personnel are required. The recommended organization is shown in Figure 5.

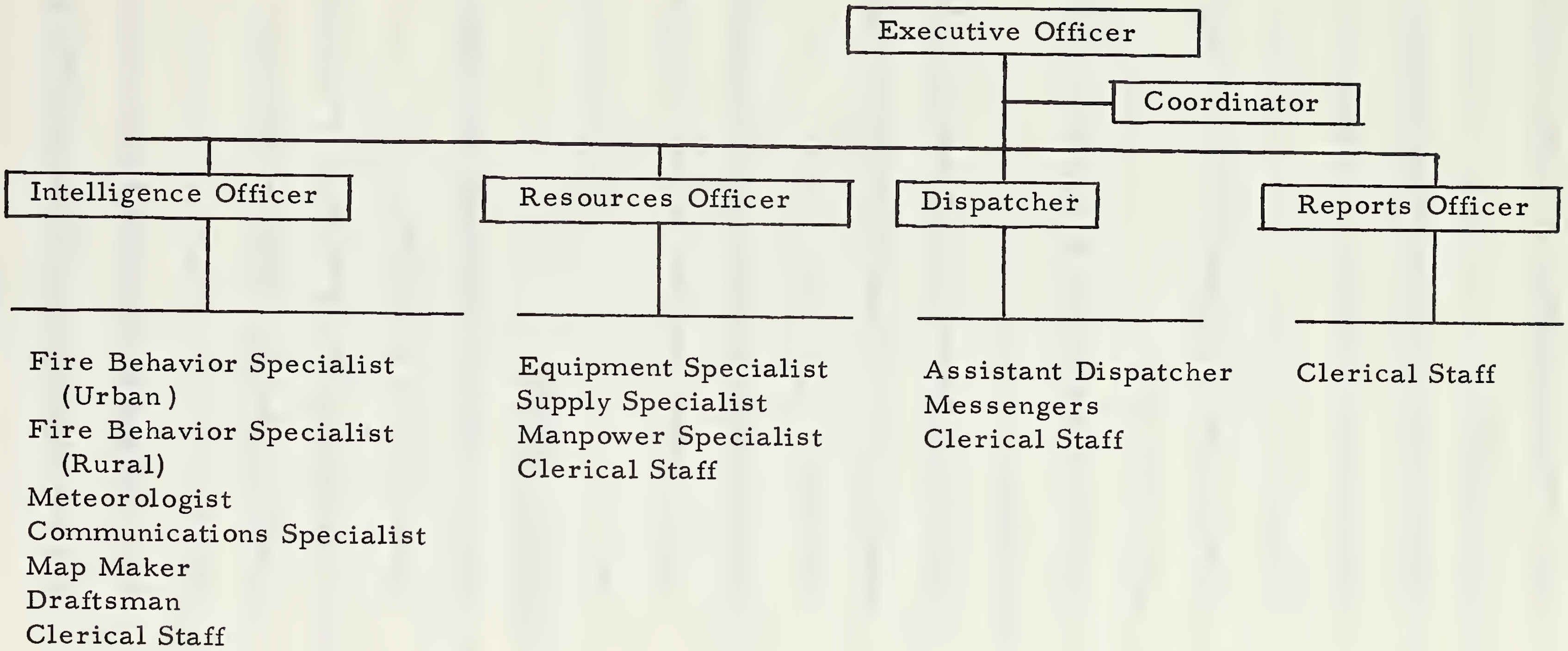
Duties of Fire Defense Operating Group Personnel

Each primary staff officer is accountable for accomplishing work as follows:

1. Executive Officer (National Fire Defense Coordinator)
   a. Directs the activities of the group.
   b. Arranges for and assigns the personnel required to do the group's work.

Figure 5

ORGANIZATION FOR THE FIRE DEFENSE EMERGENCY OPERATING GROUP



c. Represents fire defense in liaison with other Civil Defense activities.

d. Utilizes information and advice from his staff and develops recommendations for action to cope with the fire threat.

e. Presents these recommendations to the administrative group for action.

f. Activates the approved fire defense decisions.

2. <u>Coordinator</u>

a. Helps the Executive Officer consider other responsible agencies and the states when developing fire defense decisions.

b. Insures coordination with other responsible agencies and the states when fire defense decisions are carried out.

3. <u>Intelligence Officer</u>

a. Receives attack analysis and fire damage assessment data from OCD and USDA.

b. Assesses the fire threat to urban and rural areas including predictions of fire spread in the immediate future.

c. Receives and analyzes blast and radioactive fallout data and estimates the restraints imposed by fallout and

blast on fire control activities.

d. Receives, analyzes, and interprets meteorological data and translates these data into fire danger and burning indices for the entire country and territories.

e. Recommends to the Executive Officer the National level action that will aid most in reducing the fire threat.

f. Maintains a current picture of fire occurrence, location, size, and spread potential of urban and rural fires. Prepares situation map and charts.

g. Makes the maps and briefing aids required.

h. Maintains communications necessary for data gathering, utilizing all available means.

i. Maintains a file of OCD-OEP Regional and state fire defense plans.

4. <u>Resources Officer</u>

a. Currently identifies sources of available equipment, manpower, and supplies nationwide, and keeps appropriate records.

b. Recommends ways in which manpower, equipment, and supplies can be most effectively used to meet the urban and rural threat estimated by the intelligence officer.

c. Obtains clearances for procurement and movement of men, equipment, and supplies.

d. Determines and arranges claimancy for the manpower, equipment, and supplies necessary for fire defense. Fuels and equipment are especially important.

5. Dispatcher

a. Receives incoming messages, analyzes them, and recommends action to the Executive Officer.

b. Dispatches manpower, equipment, and materials as approved by the Executive Officer.

c. Maintains a log of action taken.

6. Reports Officer

a. Prepares a daily summary report for OCD-DOD and FS-USDA showing the existing fire situation, the potential fire situation, and the planned action to be taken from the National level.

b. Prepares reports for other agencies as requested.

Finance

Authority for financing fire defense activities will be implemented by Executive Order in the event of an enemy attack.

Alerting Procedures

The Chief of the Forest Service and the Director of the Office of Civil Defense will jointly activate fire defense emergency operations at the National Headquarters if a substantial increase in readiness is

required. Notification of the need for increased readiness will come to OCD and the Forest Service through normal organizational channels. The Director of OCD and the Chief, Forest Service, will alert the Operating Group by a pre-arranged plan. When alerted, members of the group will proceed to the relocation site by the most suitable means consistent with safety and security.

Three major conditions of defense readiness have been established. For convenience these are called "DEFCONS" and are numbered 1, 2, and 3. Each is described below:

<u>DEFCON 1 (Defense Condition 1)</u>

Maximum readiness of all levels of government, industry, and the public at large to take actions on receipt of an AIR RAID WARNING.

<u>DEFCON 2 (Defense Condition 2)</u>

Substantial step-up in readiness of the Executive Branch of the government. Actions taken may include those which will have an impact on other governmental organizations, non-governmental activities, and the public. Measures taken may result in some modification of day-to-day operations and may include the relocation of personnel and supporting supplies and equipment and the diversion of resources into activities more directly related to emergency operations. Actions to be taken can be

expected to come to public attention. State Governors will be notified and appropriate measures will be taken by state and local governments.

AUTOMATIC actions programmed for this condition will be those for which the response can be controlled by the organization or for which the reaction can be accurately forecast and adverse results are not expected.

DEFCON 3 (Defense Condition 3)

Moderate step-up of readiness within the Executive Branch of the Federal government. Actions taken will be strictly internal; will result in little, if any, changes in day-to-day operations; will be of such a nature as NOT to come to public attention. Automatic actions programmed for this condition will be limited to administrative measures to increase organizational preparedness posture.

DEFCONS 1, 2, and 3 will guide alerting and assembling the Fire Defense Operating Group. If an all-out alert or attack without warning by-passes the three DEFCON situations, the Operating Group should report to the relocation site as soon as possible.

ANNEXES

Annexes[1] to this appendix are:

Annex 1, Sample Fire Defense Plans.--Contains samples of fire defense plans to be used as guides by regional, state, and local planners, including discussion of basic elements common to all fire defense plans.

Annex 2, Fire Damage Assessment System.--Describes the nationwide system used for assessing fire damage from an enemy attack.

Annex 3, Nationwide Fire Intelligence System.--Describes the fire intelligence systems recommended for local tactical use and the strategic systems in use nationwide.

Annex 4, Nationwide Fire Communication Systems.--Describes the fire communications systems recommended for local use; the strategic systems available to transmit fire defense information, and explains how local systems can tie in to nationwide systems.

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[1] For interim guidance, add "to be written."

APPENDIX D

(DRAFT)

FIRE DEFENSE TRAINING PROGRAM

APPENDIX 3, PART E, CHAPTER 10

(A Draft of Proposed Appendix 3)

FEDERAL CIVIL DEFENSE GUIDE

PART E, CHAPTER 10, APPENDIX 3

FIRE DEFENSE TRAINING

March 1966

DEPARTMENT OF DEFENSE
OFFICE OF CIVIL DEFENSE

(This exhibit is written for long-term guidance. Changes necessary for interim guidance are indicated by footnotes.)

CONTENTS

TABLES

INTRODUCTION AND OBJECTIVES

Achieving the degree of readiness necessary to protect people, property, and vital resources from nuclear fire requires informed leadership by elected officials, civil defense personnel, and members of the fire services, plus cooperation and action by the public. The most effective way to develop this leadership and cooperation is through training. Fire defense training, especially training which develops understanding of the nuclear fire problem, should precede attempts to implement the required extraordinary analysis, support activities, and protective measures.

There is no intent to duplicate or suggest changes in current fire training. This appendix gives guidance for planning, conducting, and evaluating the extraordinary training needed to prepare for nuclear fires.

The ultimate objectives are to:

(1) Provide the qualified fire service personnel and informed citizens needed to successfully implement the fire defense program.

(2) Provide services to convert nuclear fire research findings to operational action promptly and effectively.

The fire defense training program seeks to: prepare fire and civil defense leaders throughout the nation to launch and sustain a program for defense from nuclear fire; qualify a nationwide cadre of fire leaders to command and staff the fire operations of large nuclear disasters; qualify local fire and civil defense officials to plan and conduct necessary activities to

defend their communities and fallout shelters from fire; and qualify citizens to act independently and in support of fire services during nuclear attack.

Training needed nationwide for fire defense, and types of people who should receive training are identified in this appendix. Prerequisites, objectives, subject coverage, guidelines, and ways to conduct the training are suggested. Training systems for meeting each specific training need, and more detailed breakdown of subject matter will be worked out in annexes to this appendix.

Some training - for example, advanced nuclear fire leadership training - is broad in scope, can be done on a centralized basis, and has common application nationwide. Other training needs to be adapted to local conditions. The fire defense training guides in this appendix are written to facilitate local adaptation where necessary.

DEFINITIONS

Definitions in the Federal Civil Defense Guide, Part E, Chapter 10, apply to this appendix. Additional definitions follow:

1. Training Systems

   The whole process of imparting the desired knowledge from beginning through effective performance by the trainee, including description and arrangement in sequence of the methods, techniques,

equipment, and aids to be used.

2. Fire Defense Training

Training required for fire defense, in addition to normal peacetime fire training.

RESPONSIBILITY

The responsibility for planning and carrying out national and regional level nuclear fire defense training and providing support and guidance for state and local training rests with Federal agencies having assigned fire defense responsibilities. Counsel and coordination with existing Fire Services, Fire Supporting Organizations, and Fire Educational Organizations will be used on the broadest basis possible. Responsibility for carrying out necessary state and local fire defense training rests with the state and local governments. (See Federal Civil Defense Guide, Part E, Chapter 10, Responsibilities)

TRAINING NEEDS

Typical training needs are determined by analyzing the objectives of the fire defense program, identifying the tasks to meet these objectives, identifying the people needed, and finally by determining the knowledge required to do the tasks. Typical fire defense training needs are summarized and this process depicted in Table 1.

TRAINING GUIDES

Nine subjects are identified in Column 4, Table 1 in which training will be needed to develop capability for successful fire defense. Advanced

equipment, and aids to be used.

2. Fire Defense Training

Training required for fire defense, in addition to normal peacetime fire training.

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The responsibility for planning and carrying out national and regional level nuclear fire defense training and providing support and guidance for state and local training rests with Federal agencies having assigned fire defense responsibilities. Counsel and coordination with existing Fire Services, Fire Supporting Organizations, and Fire Educational Organizations will be used on the broadest basis possible. Responsibility for carrying out necessary state and local fire defense training rests with the state and local governments. (See Federal Civil Defense Guide, Part E, Chapter 10, Responsibilities)

TRAINING NEEDS

Typical training needs are determined by analyzing the objectives of the fire defense program, identifying the tasks to meet these objectives, identifying the people needed, and finally by determining the knowledge required to do the tasks. Typical fire defense training needs are summarized and this process depicted in Table 1.

TRAINING GUIDES

Nine subjects are identified in Column 4, Table 1 in which training will be needed to develop capability for successful fire defense. Advanced

TABLE 1 ANALYSIS OF OPERATIONAL FIRE DEFENSE TRAINING NEEDS

1. Fire Defense Objectives →

1. To reduce loss of life and resources from fire to acceptable limits at tolerable costs.
2. Develop & maintain capability to withstand fires resulting from enemy attack.
3. Fully utilize the fire defense potential of the citizens.
4. Conduct fire defense research and development.[1]
5. Employ all feasible pre-attack measures to reduce the fire threat.
6. Integrate nuclear fire requirements to enhance peacetime fire operations.

Footnotes

1 Analysis of tasks, personnel and training needed for fire defense research are not included.

2 In addition to the needs listed, radiological monitoring training as required by local assignment is necessary.

3 This basic knowledge is also required for people listed in Column 3, 1-11.

2. Tasks to Perform to meet objectives →

1. Make a Nuclear Fire Analysis of each community.
2. Identify, evaluate, and employ effective protection measures.
3. Implement a citizen's fire extinguishing and prevention program.
4. Inspect, rate, and correct fire vulnerability of fallout shelters.
5. Prepare to defend shelters from within from fire.
6. From without from fire.
7. Take selective organized fire suppression and rescue actions trans & post-attack.
8. Gather fire intelligence trans and post-attack data.
9. Extinguish small fires, wherever they are, before they join and become large fires.
10. Reduce fire spread potential in communities and rural areas.
11. Plan effective fire defense for each community.
12. Currently utilize the latest scientific & technological advances in fire defense.
13. Integrate fire defense activities with the overall management of each disaster area.
14. Integrate peacetime fire operations with defense requirements.
15. Design the systems, equipment, & methods needed for tasks 1 - 14.

3. People Needed to do the Tasks → 4. Training Needed[2]

3. People Needed to do the Tasks	4. Training Needed[2]
1. National Fire Defense Coordinator and Staff 2. Fire experts for disaster Manager's Staff 3. OCD Regional Fire Defense Coordinators and Staffs 4. USDA Regional Office Fire Staffs 5. USDI Regional Office Fire Staffs 6. State Fire Coordinators, Fire Marshals, and State Foresters 7. State CD Directors 8. OEP Regional Office Staff	1. Advanced nuclear fire leadership training. 2. Fire Research Seminar.
9. County & City CD Directors 10. Local Fire Coordinators and Staffs - Urban, Rural, USDA, Forest Staffs, Interior Field Staffs	3. Local nuclear fire leadership training.
11. Rural citizens in organized crews	4. Rural Fire Defense Training
12. Supervisory firemen; urban & rural	5. Basic nuclear fire defense training[3]
13. Citizens to support urban fire services	6. Fire Defense Support Fireman Training
14. Citizens to act independently	7. Householder self-help training
15. Shelter Inspectors	8. Shelter Inspection & Rating training
16. Shelter Managers 17. Shelter Fire Wardens	9. Shelter Fire Defense
18. Military Personnel	10. Training in 1, 2 and 5 above depending on type of assignment.

nuclear fire leadership training and Fire Research Seminars should be arranged by the Office of Civil Defense with other agencies and organizations participating as necessary. Information about the availability of this training should be published by OCD periodically to inform fire and civil defense personnel so attendance can be arranged. The remaining fire defense training, plus special training to meet local problems, is to be conducted by state and local governments. (See Responsibility, page A-4)

Training guides follow for each training need. Essential subject matter is identified, but local units will need to adjust the content of their training to fit local needs.

ADVANCED NUCLEAR FIRE LEADERSHIP TRAINING

Prerequisites.--Must be either a qualified state, regional, or national fire staff member or coordinator, a civil defense director, a state fire marshal, a state forester, a military officer with fire defense responsibilities, an urban or rural fire chief with proven managerial ability, or have equivalent experience to any of the foregoing prerequisites. Must have completed basic nuclear fire defense training or passed the examination for this course.

Objectives.--After this training each trainee should be able to:

1. Explain the relationship of civil defense to the total defense of the nation.
2. Explain the nuclear fire threat and define this threat for their

geographical areas.

3. Conduct a nuclear fire analysis for a community or other planning area.
4. Prepare a state or region fire defense plan, including protective measures, support measures, and training required to implement the plan.
5. Evaluate the effectiveness of alternative pre-attack protective measures and direct their employment.
6. Coordinate trans and post-attack fire control operations at a state or regional level.
7. Serve on a disaster manager's staff and direct fire operations in a large nuclear disaster area. (This is a special option.)
8. Integrate peacetime fire operations with fire defense requirements in his area of responsibility.
9. Organize and achieve an effective fire defense program for his area of responsibility.

<u>Subject Coverage.</u>

1. The Nuclear Fire Threat
    a. Blast, fallout, fire relationships.
    b. The nuclear fire threat to the U.S.
    c. Interpreting the nuclear fire threat locally.
    d. Relating fire defense to total civil defense.

2. The Nuclear Fire Analysis

   a. The analysis system.

   b. Conducting the local nuclear fire analysis.

   c. Identifying and evaluating protective measures.

   d. Achieving nuclear fire analysis within communities in area of responsibility.

3. Fire Defense Plans

   a. Establishing the basis for the plan.

   b. Relating to the national fire defense plan.

   c. Purpose and contents of the regional fire defense plan.

   d. Purpose and contents of the state fire defense plan.

   e. The local fire defense plan.

   f. Integrating peacetime fire planning into the fire defense plan.

   g. Implementing the fire defense plan.

   h. Enabling legislation.

   i. Predicting emergency needs and claiming resources.

4. During and Post-Attack Operations

   a. Intelligence and damage assessment.

   b. Organizing at the state or OCD regional level.

   c. Determining priorities at the state or OCD regional level.

   d. Coordinating fire operations at the state or OCD regional level.

   e. Communications.

f. Organizing and managing fire operations in the disaster area. (A special option for tactical fire staffs who will serve in disaster areas.)

(1) Disaster management organization.

(2) The role of the fire staff.

(3) Tactics.

(4) Equipment.

(5) Shelter defense.

(6) Tactical intelligence.

(7) Priorities and timing.

(8) Rescue and evacuation.

(9) Radiological monitoring.

(10) Communications.

(11) Large fire behavior principles.

5. Achieving an Effective Fire Defense Program

a. Relating to peacetime fire activities.

b. Motivating local governments and the citizenry.

c. Utilizing Federal CD cost-sharing programs.

d. Leadership requirements from the state or OCD regional level.

e. How to use local, regional, state, and interstate compacts.

f. Integrating rural and urban operations.

Guidelines.--This training is intended to give fire service personnel, or

other defense officials with fire background and responsibility, the knowledge to plan and implement effective fire defense within the framework of the National Fire Defense Plan. In addition, the special option will prepare fire managers to manage the fire aspects of a large nuclear or natural disaster area. The training is aimed at understanding the nuclear fire threat, the systems required to analyze this threat, national fire defense policies and plans, methods for planning fire defense, and fire defense operations during a nuclear disaster. Approximately 4 weeks training is contemplated.

Location of Training.--Selected fire education organizations, fire supporting organizations, or fire services having the necessary capability.

Training Methods.--To be worked out after a system is designed for the training.

Some Helpful References.

Bond, Horatio (Editor)
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Cohn, B. M., L. E. Almgren, and M. Curless
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Countryman, Clive M.
1964. Mass Fires and Fire Behavior, USFS for OCD

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1965. Role of the Fire Services in Nuclear War, System Sciences Company for the USFS

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1965. A Disaster Planning Manual for Small Communities, Bio Dynamics, Inc. for OCD

Kimball, Warren R.
1962. Fire Defense on a National Scale, National Fire Protection Association, Published in Firemen

Martin, Thomas L., Jr., and D. C. Latham
1963. Strategy for Survival, Univ. of Arizona Press

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Moore, William R., J. W. Jay, and J. H. Dieterich
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Phung, P. V. and A. B. Willoughby
1965. Prediction Models for Fire Spread Following Nuclear Attacks, URS Corp. for OCD

Salzberg, F., M. M. Gutterman, and A. J. Pintar
1965. Prediction of Fire Damage to Installations and Built-up Areas from Nuclear Weapons - Final Report, Phase III Theoretical Studies. Prepared for OCD by IIT Research Institute

Smith, J. B., E. W. Cousins, M. J. Miller, and R. M. Newman
1964. Fire Safety Upgrading for Fallout Shelters in Buildings, Final Report, Factory Mutual Research Corp. for OCD

Strope, Walmer E. and J. F. Christian
1964. Fire Aspects of Civil Defense, OCD

The National Plan for Emergency Preparedness, Office of Emergency Planning, 1964.

Varley, R. B. and G. L. Maatman
1965. Shelter Fire Vulnerability - Survey and Analysis of Representative Buildings, IIT Research Institute for OCD

Vodvarka, F. J. and T. E. Waterman
1965. Fire Behavior, Ignition to Flashover, IIT Research Institute, for OCD

Wilson, Rexford
Protecting your City from Conflagration - by design, National Fire Protection Association

FIRE RESEARCH SEMINAR

Prerequisites.--Must be either a qualified state, regional, or national fire staff or coordinator, a state civil defense director, a state fire marshal, a state forester, a military officer with fire defense responsibilities, an urban or rural fire chief or have equivalent experience to any of the foregoing. In addition, must be in a position where he has opportunity to extend the knowledge to others.

Objectives.--After this training each trainee should be able to:

1. Describe the latest fire research findings in operationally useable terms.

2. Apply these findings in the programs for which he is responsible.

3. Explain these findings to others in this geographical area of responsibility.

4. Describe major fire problem areas where research is being done.

Subject Coverage.--Subjects will be covered as necessary to up-date the trainees on the latest research findings pertinent to fire defense.

Guidelines.--This training should be held periodically to help operational fire leaders up-date their understanding of nuclear fire research. Frequency of the seminars would depend on the amount and significance of research findings since the last seminar. Explanation of how these findings can be most effectively used in operational programs should be included. Length of the seminars will depend on the subjects to be covered.

Location of the Training.--OEP-OCD regions

Training Methods.--Seminars sponsored by OCD to bring the trainees together with representatives of organizations conducting research in nuclear fire.

Some Helpful References.--Use appropriate state of the art summaries and parent documents.

LOCAL NUCLEAR FIRE LEADERSHIP TRAINING

Prerequisites.--Must have responsibility for tactical fire and related rescue leadership in a local area such as a city, county, or intra-state zone and completed basic nuclear fire leadership training or passed the examination for this course.

Objectives.--After the training each trainee should be able to:

1. Conduct a nuclear fire analysis for his locality.
2. Analyze the nuclear fire threat to his locality and choose the most effective protective measures.
3. Prepare effective fire defense plans for his locality.
4. Activate pre-attack protective measures when warning is received.
5. Direct fire suppression and rescue activities in his locality during emergencies.

Subject Coverage.--Subject coverage is the same as for national nuclear fire leadership training but the training will deal with specific local situations. Fire management in the disaster area, shown as a special option in National Nuclear Fire Leadership Training, is mandatory for local nuclear fire leadership training.

Guidelines.--This training is intended to give fire professionals and other defense officials with local level fire responsibilities, the knowledge required to plan and implement effective fire defense in their

specific localities. The trainees are already qualified in peacetime fire prevention and control, but some may not have experience or qualifications to manage large fires. Approximately two weeks training is contemplated.

Location of Training.--At or near the locality where the trainees have responsibilities. People who will face the disaster together should train together. Training should be conducted jointly by state CD and fire services personnel. Graduates from National Nuclear Fire Leadership Training would be especially well qualified to organize local training and instruct.

Training Methods.--Combination of group training, field problems, and practice.

Some Helpful References.

Available state, intra-state zone, and local peacetime fire and fire defense plans.

Bond, Horatio (Editor)
1946. Fire and the Air War, National Fire Protection Assn.

Chandler, Craig C., T. G. Storey, and C. D. Tangreen
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Moore, William R., J. W. Jay, and J. H. Dieterich
1965. Phase One Report, National Fire Coordination Study, USFS for OCD

The National Plan for Emergency Preparedness, Office of Emergency Planning, 1964.

Pertinent state laws, local ordinances, and mutual aid agreements.

Regional or local classification guides for rural fuels.

Smith, J. B., E. W. Cousins, M. J. Miller, and R. M. Newman
1964. Fire Safety Upgrading for Fallout Shelters in Buildings, Final Report, Factory Mutual Research Corp. for OCD

Strope, Walmer E., and John F. Christian
1964. Fire Aspects of Civil Defense, OCD

Varley, R. B. and G. L. Maatman
1965. Shelter Fire Vulnerability - Survey and Analysis of Representative Buildings, IIT Research Institute for OCD

BASIC NUCLEAR FIRE DEFENSE TRAINING

Prerequisites.--Must be a paid or volunteer supervisory fireman or fire manager with demonstrated ability to supervise crews of men under emergency conditions. Must be proficient in the logistics and tactics used for peacetime fire control in his community.

Objectives.--After this training each trainee should be able to:

1. Describe the important differences between his peacetime problems of fire control and those during and following a nuclear attack.
2. Describe the relationships of nuclear blast, fallout, and fire.
3. Explain how and where ignitions take place as a result of a nuclear detonation.
4. Describe the fundamentals of nuclear fire behavior.
5. Describe the typical differences and similarities between fire spread in urban and rural areas.
6. Use a dosimeter and explain its use to others.
7. Explain how radiological monitoring is used in connection with nuclear fire control and how to obtain these services.
8. Identify on-site urban, and rural fuels capable of creating fires with serious threat.
9. Operate and supervise the operation of improvised and special hand-operated equipment used in the fire defense program.

10. Describe the citizens' role in protection from the nuclear fire threat.

11. Mobilize, train, and supervise citizens to suppress small fires under nuclear attack conditions.

<u>Subject Coverage.</u>

1. Fundamentals of Nuclear Fire

   a. Generation of thermal energy by nuclear weapons.

   b. Transmission of thermal energy through the atmosphere.

   c. Ignition capabilities of various sizes of nuclear weapons by height of burst.

   d. Typical patterns of ignitions from nuclear weapons.

   e. Spread of fires - urban and rural.

   f. Development of conflagrations and fire storms.

   g. Blast, fallout, fire relationships.

2. The Nuclear Fire Threat

   a. Relative severity of the blast, fallout, and fire threat.

   b. The fire situation expected in or near ground zeros following a nuclear attack.

   c. The fire situation expected in areas affected by fallout but not blast and thermal pulse.

   d. Effects of the fire threat to occupants of fallout shelters.

   e. Implications of fuels, weather, and topography.

3. Coping With the Nuclear Fire Threat

   a. Basic protective measures.

   b. Sources of radiological monitoring.

   c. The nuclear disaster job of the fire services.

   d. The fire protection role of the citizens in nuclear disaster.

   e. Shelter defense and rescue.

   f. Improvised and hand-operated equipment for citizens' use.

   g. Using the dosimeter.

4. Supervising the Citizen Crew

   a. Organizing the citizen crew in emergencies.

   b. Training the citizen crew on the job under emergency conditions.

Guidelines.--This training is intended to give supervisory firemen or fire managers the basic information required to understand the severity and complexity of nuclear fire, including relating the nuclear fire problem to the problems of fire control typically experienced in peacetime. Except for training in how to effectively use citizens, fire control methods and tactics are not included because the trainees are already qualified firemen. Though intended for qualified firemen, the training will be valuable to others who need to understand the basic problems of defense from nuclear fire. Subjects common to the needs of both urban and rural supervisory firemen are covered, however, preparations of

detailed lesson plans might reveal subject areas where rural and urban options are needed. Approximately one week's training is contemplated.

Location of Training.--Training done at local level, as part of the fire services' regular training program.

Training Methods.--Lesson plans, programmed text, simulation materials and other aids prepared by OCD. Combination of group instruction, simulation, and programmed instruction.

Some Helpful References.

About Fallout, 16 MM Film, OCD Film Library

Cohn, B. M., L. E. Almgren, and M. Curless
1965. A System for Local Assessment of the Conflagration Potential of Urban Areas, Gage-Babcock & Associates, Inc. for OCD

Crowley, John W. and F. G. Stahl
1964. The Fire Problem in Nuclear War (Unclassified excerpts) System Sciences Co. for USFS (Classified CONFIDENTIAL)

Crowley, John W., M. H. Letts, and F. G. Stahl
1965. Role of the Fire Services in Nuclear War, System Sciences, Co. for the USFS

Fire Weather, 16 MM Film, USDA Motion Picture Film Library

Introduction to Fire Behavior, 16 MM Film, by USFS

Introduction to the Fundamentals of Fire Behavior; a programmed text, by USFS

Martin, Thomas L. and D. C. Latham
1963. Strategy for Survival, Univ. of Arizona Press

Moore, William R., J. W. Jay, and J. H. Dieterich
1965. Phase One Report, National Fire Coordination Study, USFS for OCD

Regional or local classification guides for rural fuels.

Strope, Walmer E. and J. F. Christian
1964. Fire Aspects of Civil Defense, OCD

URBAN FIRE DEFENSE SUPPORT FIREMAN TRAINING

Prerequisites.--Must be physically capable of suppressing small urban fires, have interest in fire defense, and be willing to supervise a small crew of citizens under emergency conditions.

Objectives.--After this training, each trainee should be able to:

1. Extinguish small urban fires, using hand extinguishers, hand tools, or improvised methods.
2. Supervise a small untrained crew in extinguishing small urban fires.
3. Use radiological monitoring information for his personal protection and the protection of others.
4. Explain the potential nuclear fire threat to his locality.
5. Effectively assist the fire services to suppress fires under nuclear attack conditions.
6. Assist in defending public fallout shelters from fire.
7. Apply fire prevention and protective measures applicable to his area, and explain these measures to others.

Subject Coverage.

1. The Nuclear Fire Threat

    a. Relative severity of the blast, fallout, and fire threat.

    b. The fire situation expected in or near ground zeros following a nuclear attack.

    c. Spread and joining of small fires to become large fires.

    d. The fire situation expected in areas affected by fallout, but not blast and thermal pulse.

    e. Effects of the fire threat to occupants of fallout shelters.

2. The Support Fireman's Independent Role in Fire Defense

    a. Cleanup and prevention programs.

    b. Activating basic protective measures.

    c. Survival arithmetic and using the dosimeter.

    d. Using hand tools, extinguishers and improvised equipment.

    e. Supervising the citizen crew.

    f. Tactics for suppressing small fires.

    g. Protecting fallout shelters from fire.

3. Assisting Regular Firemen in Emergencies

    (to be completed by a group of urban firemen)

Guidelines.--This training should develop a cadre of trained citizens in urban areas to lead small citizen groups to suppress small fires,

assist professional firemen, and help defend community shelters from fire. The most effective role of these support firemen would be to extinguish, control, or assist the fire service in controlling fires at or near their shelters or in their neighborhoods. Trainees should be selected for their leadership ability and to achieve geographical distribution throughout the urban areas. Approximately 40 hours training is contemplated.

Location of Training.--Usually will be done by the fire departments at the local level with guidance from the state and using training materials and aids supplied by OCD.

Training Methods.--Combination of group training, simulation, programmed learning, and practice drills.

Some Helpful References.

About Fallout, 16 MM Film, OCD Film Library

Crowley, John W., M. H. Letts, and F. G. Stahl
1965. Role of the Fire Services in Nuclear War, System Sciences Co. for USFS

Federal Civil Defense Guide, Part E, Chapter 10, Fire Defense and Appendices and Annexes thereto.

Martin, Thomas L. and D. C. Latham
1963. Strategy for Survival, Univ. of Arizona Press

Moore, William R., J. W. Jay, and J. H. Dieterich
1965. Phase One Report, National Fire Coordination Study, USFS for OCD

Strope, Walmer E. and J. F. Christian
1964. Fire Aspects of Civil Defense, OCD

VanDersal, William, Harper, and Row
1962. The Successful Supervisor

RURAL FIRE DEFENSE TRAINING

Prerequisites.--Must be physically able to suppress fires and have interest in rural fire defense.

Objectives.--After this training each trainee should be able to:

1. Predict fire behavior under varying conditions.
2. Work as an effective team member in a firefighting crew.
3. Use basic tactics required to suppress fires in his area.
4. Use radiological monitoring information for his personal protection.
5. Direct measures for public safety in shelters.
6. Participate effectively in rescue and evacuation operations.
7. Decontaminate tools and equipment.
8. Effectively operate fire equipment commonly used in his locality and adjacent areas.
9. Locate and define fire hazards and risks common to his locality.
10. Use fire prevention practices adapted to his area.
11. Do the tasks required in his fire defense specialty, if he chooses a specialty.

Subject Coverage.

1. Basic Subjects.

    a. Firemanship orientation.

    b. Fire behavior fundamentals.

    c. The nuclear fire problem.

    d. Organization for rural fire suppression in the nuclear age.

    e. Use and sources of radiological monitoring information.

    f. Structural tactics.

    g. Grassland and grain field fire tactics.

    h. Forest and brush fire tactics.

    i. Flammable liquid fire tactics.

    j. Pumping on nuclear fires.

    k. Overhaul, mopup, and salvage.

    l. Hand tools.

    m. Rural fire prevention.

    n. Rescue and evacuation during nuclear or natural disasters.

    o. First aid.

    p. Review of Civil Defense.

2. Special Options.

    a. Radiological monitoring.

    b. Rescue.

    c. Shelter management.

d. Shelter fire inspections, rating, and protection.

e. Nuclear fire analysis of rural areas.

f. Radiological decontamination.

g. Fire behavior.

h. Management of small fire departments.

i. Structural firefighting.

j. Wildland firefighting.

k. Prevention and protective measures.

Guidelines.--The basic subjects in this training are for people in rural areas with little or no experience or qualifications in fire activities. Rural firemen should not take these basic subjects unless a beginning examination reveals they need them. Approximately 40 hours of basic training is contemplated.

The special options, varying from 8 to 40 hours of instructions, permit those persons with special interests and responsibilities to become proficient in the specialty of their choice. Some of these special options may be valuable to experienced firemen.

Location of Training.--Usually held at the local level with instructors trained and training materials supplied by the state.

Training Methods.--Combinations of group instruction, simulation, programmed instruction, and actual practice.

Some Helpful References.--See materials developed for pilot programs in the states of Colorado, Oregon, Kentucky, Florida, and Missouri.

HOUSEHOLDER SELF-HELP TRAINING

Prerequisites.--none

Objectives.--After this training each trainee should be able to:

1. Explain how fire ignitions occur from nuclear detonations.
2. Describe how fires could spread in his community.
3. Identify the fire hazards in or adjacent to his home.
4. Remove or correct common fire hazards in or adjacent to his home.
5. Put protective measures into effect in his home when warned of impending attack.
6. Use fire extinguishers, hand tools, or improvised methods to suppress small fires.
7. Explain the potential threat to himself and family from radioactive fallout.
8. Describe the actions he must take to suppress and prevent fires before taking shelter from fallout and during the period he is confined to the shelter.

Subject Coverage.

1. The householder's role in peacetime - in wartime.
2. Blast, fallout, and fire relationships.
3. How nuclear weapons start fires.
4. Effects of weather, smoke, and smog upon nuclear ignitions.
5. How small fires spread to become large fires.
6. Common fire hazards in the home.
7. Clean homes are safe homes.
8. Hiding flammable home furnishings from thermal flash.
9. Putting home protective measures into effect.
10. Using fire extinguishers and hand fire suppression tools.
11. Fighting home fires with improvised methods.
12. Defending your home shelter from fire.
13. Steps to take if an attack occurs.
14. Attack warning procedures.

Guidelines.--This training should prepare householders in urban, suburban, and rural areas to: reduce potential ignition points in or near their homes; activate protective measures in their homes when warned of attack; and extinguish small fires before taking shelter from fallout. The householders should learn enough about blast, fallout, and fire relationships and nuclear fire ignition and spread, to understand why they are to take protective action. They should under-

stand that, during an attack, their self-help fire actions are necessary to enable fire departments to deal with the overall fire threat. They should learn what protective measures to take and be encouraged to practice with the necessary equipment. This training will be supplemented with TV and radio instructions.

Location of Training.--Training to be done locally using a kit of materials prepared by OCD.

Training Methods.--Combined group training, self-study and TV instructions.

Some Helpful References.

Fallout Protection, What to Know and Do About Nuclear Attack, and OCD publication

Federal Civil Defense Guide, Part E, Chapter 10, Fire Defense, Appendices and Annexes thereto.

Firefighting for the Householder, an OCD publication

Home Protection, an OCD publication

Martin, Thomas L. and D. C. Latham
1963. Strategy for Survival. Univ. of Arizona Press

Strope, Walmer E. and J. F. Christian
1964. Fire Aspects of Civil Defense, OCD

U. S. Forest Service
1962. Rural Fire Defense, You Can Survive.

FALLOUT SHELTER INSPECTION AND RATING TRAINING

(to be written)

SHELTER FIRE DEFENSE TRAINING

(to be written)

IMPLEMENTING TRAINING

Attending advanced nuclear fire leadership training will help regional and state fire and Civil Defense leaders implement the necessary fire defense training in their areas. Federal Civil Defense Guide, Part F, Chapter 1, Training, suggests overall state and local actions and identifies Federal assistance available to help with the training.

EVALUATING RESULTS OF TRAINING

See Federal Civil Defense Guide, Part F, Chapter 1, Training.

STATE AND LOCAL ACTIONS

State governments and participating Federal agencies should:

1. Identify candidates for advanced nuclear fire leadership training and the Fire Research Seminars; then arrange for their participation in national and OCD regional courses.

2. Arrange for the graduates from national nuclear fire leadership training to plan fire defense programs and conduct local nuclear fire leadership programs in their states.

3. Utilizing graduates of local nuclear fire leadership training as leaders, local governments should develop fire defense programs for their communities and train the personnel required to implement these programs if an attack occurs.

ANNEXES

Annex 1, Fire Defense Training Handbook.[1]

Contains diagrams and descriptions of the training systems recommended for conducting the training described in the training guides, and summaries of instructional materials and devices for each system.

[1] For interim guidance, add "to be written."

APPENDIX E

FINDINGS FROM ADMINISTRATIVE STUDIES

FINDINGS FROM ADMINISTRATIVE STUDIES

These studies were in five categories and were reported as shown below:

Briefing Meetings: Urban and rural fire leaders participated in regional meetings held at Los Angeles, Portland, Chicago, Boston, and Memphis. The ideas developed were reported in:

"Fire Service Briefing". (59)*

Past Recommendations: Related operational studies made in the past were reviewed and considered in the report:

"Analysis of Past Recommendations". (61)

Mutual Aid Studies: Samples of present-day fire planning and readiness activity was obtained by studying Fire Mutual Aid Arrangements in:

California (87)

Oregon (18)

Michigan (80)

Massachusetts (5)

Washington, D. C. (52)

These five mutual aid studies were summarized in:

"Combined Mutual Aid Analysis". (62)

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* Reference Numbers Refer to Bibliography

Fire Studies: Tactical fire control practices were examined and related to the nuclear fire problem by studying ten large fires as follows:

Deadwood Fire, So. D. (28)

Park Headquarters Fire, So. D. (29)

Boston Fires (four fires studied) (30)

General Dynamics Fire, Bayonne, N. J. (31)

Russwood Ball Park Fire, Memphis, Tenn. (33)

Nevada Fires (47)

Roseburg Oregon Fire & Explosion (48)

Coyote Fire, California (89)

Santa Rosa Fires, California (91)

Los Angeles Riot Fires (93)

Selected Disasters: Reports from 12 selected disasters, including fires, earthquakes, hurricanes, explosions, and a dam failure were reviewed. The significant implications were grouped by functions that relate to large fire emergencies in the report:

"Selected Disaster Summary". (34)

The most significant findings from these Administrative Studies are:

1. Pre-Emergency Planning

   A. A community prepared to at least partially cope with a nuclear disaster is well prepared to react to most natural disasters.

B. Because public utility companies generally have no legal responsibility to furnish service to their customers in the event of a natural disaster, they should be represented at pre-emergency planning sessions. Plans should include measures to restore emergency service in the event of fallout.

C. Evacuation plans should utilize weather forecasts and be made to handle (a) strategic evacuation during international stress (b) tactical evacuation of fire areas, or fallout areas if shelter is lacking, and (c) evacuation of survivors from target areas after an attack.

D. Plans are usually deficient in resource inventories, definition of command, and joint training.

E. To cope with nuclear fire, plans should include provisions for a more extensive exchange of mutual assistance.

2. Command Responsibilities

A. It is often not clear at the local level who would be in command of the tactical fire situation in a nuclear emergency.

B. Establishment of a central command makes large fire suppression efforts more effective.

C. Nuclear fires in urban areas would create command problems similar to the large peacetime rural fires.

D. The final responsibility for decisions affecting the lives of

citizens rests with elected officials.

3. Citizen Action

Both trained and untrained citizens will respond to provide help during a nuclear-caused fire emergency. Trained citizens are more effective but the untrained individual working under a trained supervisor can provide worthwhile assistance. A great deal of reliance would need to be placed on the general public.

4. Equipment

A. Equipment shortages were a common occurrence on large peacetime fires. As part of the local disaster plan, a complete inventory of equipment and personnel available is needed.

B. Aircraft use should be expanded, through planning, to include possible use on nuclear fire disasters.

C. There is a need to develop additional specialized fire equipment for use on nuclear fires.

D. Materials likely to be in short supply during a disaster should be identified and provisions made to prevent the shortages from occurring.

5. Communications

A. Communications were generally inadequate for large fires or multiple fires burning in a localized area. Radio frequencies became overloaded and different frequencies are

not adequately tied together.

B. Commercial radio is the most important media for keeping the public informed of disaster conditions. Operating on emergency power, official messages can be effectively transmitted to transistorized radio equipment in shelters and homes.

6. <u>Hazard Reduction</u>

Fire planning should include ignition point reduction, zoning, community planning to prevent fire spread, and treatment of rural fuels that create a fire threat to urban areas.

7. <u>Multiple Fires</u>

Multiple fires in wildland fuels, such as may be created by a lightning storm or by widespread incendiary activity, are generally handled only with great difficulty. Much reliance is placed on speedy attack by small crews to prevent widespread destruction. Nuclear attack fires in urban areas would need a similar individual or small group effort to prevent mass fires from developing.

8. <u>Intelligence</u>

Existing strategic and tactical intelligence systems and resource locator and dispatching systems would generally be inadequate for nuclear fires.

9. Training

Fire services are providing excellent tactical training for firemen. Leadership training in understanding the nuclear fire problem at the national, state, and local levels is a high priority need. Public service personnel who will face the problem together should train together.

10. Urban Fire Spread

A. Ignition and fire spread in urban fuels is less dependent on weather but destructive urban fires are frequently associated with critical fire weather. Fire weather forecasts and probabilities are basic to more effective fire control operations.

B. Fires spread in urban areas by direct exposure (radiation) or by fire brands carried aloft by winds and convection currents. Structural characteristics that influence fire spread include building size and spacing, size of window openings, interior and exterior construction materials, and building contents. Structural fires, like wildland fires, spread relatively slowly into the wind so streets and parkways may effectively halt fire spread. Urban fires may spread long distances with the wind due to transport of fire brands and even the widest parks or freeways may prove inadequate as an effective break.

11. Fallout Shelter Protection

Fallout shelters in or near a target area may be exposed to fire from several sources: the thermal flash may start fires within the building; blast damage to the shelter could cause secondary ignitions; spreading fires could threaten the building from the outside; and fire could occur due to carelessness within the building or shelter area. Shelter fire protection measures must be designed to protect the shelter's occupants by eliminating the threat, or minimizing the damage resulting from any of these sources.

12. General

A. Fire manpower and equipment are not always in balance. Some fire companies are not able to fully man the equipment available to them.

B. The magnitude and complexity of the nuclear fire threat is not generally understood by fire service personnel at the local level.

C. A nuclear disaster problem area could include several political jurisdictions.

APPENDIX F

SUMMARY OF OPERATIONAL GUIDES

SUMMARY OF OPERATIONAL GUIDES

To make research more effective in developing and implementing the fire defense program, pertinent findings have been converted to operational guidelines. When research findings conflicted or available results were incomplete, judgment was exercised by the study team to develop the operational guidelines.

This summary of operational guides includes material from unclassified research reports. Several classified reports were also reviewed to determine if they contained information that would materially alter the basic conclusions. No such information was identified and consequently the preparation of a classified research summary was not necessary (See Bibliography).

Operational guides are summarized below by functional categories.

<u>Attack Assumptions</u>:

1. Precise delivery accuracy is not important for nuclear weapons to ignite large areas.
2. Megaton yield weapons detonated at altitudes above 50 miles would be relatively ineffective in starting primary fires. This establishes a ceiling on burst height for maximizing fire effects on the ground.
3. Exotic modes of attack would not be fruitful, at least until there are effective defenses against the more conventional

kinds of attack.

4. A surprise attack on this country is considered less likely than an attack resulting from lesser military and political action.

5. As the element of a surprise attack decreases, the probability of more effective civil defense actions increases.

Modification of Nuclear Thermal Radiation by Environment:

1. Estimating visibility and atmospheric transmissivity are the greatest sources of error in predicting initial ignitions at the target if yield and height of burst are known.

2. Estimates of atmospheric transmissivity from a high altitude nuclear detonation on an "average" clear day are reliable to within $\pm$ 30%.

3. Weather can be a dominating factor in determining the extent of initial ignitions over large areas. Under one set of assumptions a 10 mt. burst at 35,000' clear weather ignition radius is 22 miles; cloudy weather ignition radius less than seven miles.

Response of Target Elements to Direct Nuclear Thermal Radiation:

1. The effects of a very short, intense thermal pulse on ignition of materials having variable moisture content and complex geometrical arrangement is unknown.

2. Numerous small fires will occur following an attack if a sufficient level of thermal energy reaches kindling fuels.
3. Newspapers are an important thermal ignition source because they are such a common household item.
4. At present, the prediction of ignitions from large yield bursts at intermediate altitudes is not reliable.
5. Densities of ignition points in the initial ignition radius outside the blast ring decreases with distance from ground zero, and varies with type and distribution of fuel at a given distance.
6. Thermal pulse from megaton yield, high altitude explosions may have durations of milliseconds; sea level explosions may take several to tens of seconds.
7. Megaton yield weapon bursts at altitudes between 30 and 50 miles produce an intense thermal pulse of about one second duration at ground level.
8. Estimates vary of the ignition requirements of materials exposed to thermal radiation from nuclear weapons of any yield. Errors as large as 70 percent can result in estimating the ranges at which material will ignite from nuclear detonations.

Target Vulnerability:

1. Blast damage to property and personnel is the most certain

effect that an attacker can count on.

2. Fire will be a significant factor in causing injuries, loss of life, and destruction of property following a nuclear attack.

3. At certain times of the year, forested areas are quite vulnerable to fire from a nuclear thermal pulse.

4. Interior fuels are relatively insensitive to weather and will ignite readily from direct exposure to a thermal pulse of sufficient magnitude.

5. Existing shelter buildings are predominantly fire resistant but self-help fire extinguishment effort would be needed to insure safety of shelter occupants.

6. Multi-story reinforced concrete structures suffer moderate damage at about ten psi; residential structures suffer similar damage at about three psi.

7. Wildlands contain very few items which are responsible for ignition by blast effects (secondary fires) and the possibility of a fire starting is almost entirely a function of the availability of ignitable kindling fuels.

Fire Development and Spread:

1. The very number of fires resulting from a nuclear attack will preclude their total extinguishment by professional firefighters.

2. Mass fires must be prevented by extinguishing building fires before they can join together.
3. Information is lacking on mechanism of fire spread in urban and rural areas, and the coalescence of fires into a mass fire situation.
4. Primary ignitions will usually be more important than secondary ignitions in the ultimate development of mass fires.
5. Secondary ignitions will become generally less significant relative to primary ignitions as weapons size increases.
6. Estimates of secondary ignitions based on Japanese data indicate approximately one ignition per 150,000 sq. ft (three-block area in U. S.).
7. Convection columns resulting from mass fires may alter the expected fallout pattern.
8. Weather patterns that favor fast-spreading, high intensity fires in rural fuels are known and may be predicted with fair degree of accuracy.
9. Mass fires are most likely to develop in heavily built-up urban areas. Some investigators feel that firestorms could not develop in rural areas because of too low fuel volumes.
10. The conditions most favorable to mass fires are densely

built-up urban areas, heavy fuels in rural areas, high density of ignitions, and low wind speed.

11. In cities fire spread depends more on spacing and type of construction than on weather.

12. Fires are not likely to spread between blocks (across distances exceeding 70 ft.) by radiation.

13. Spotting ahead by flying brands is the most important spread mechanism in the worst fires on record.

14. Heat radiation from burning fuel beds, rather than flames, is the most important mechanism for spreading fire in no-wind condition.

15. Exposure fires would be expected in about one-half of the surveyed buildings located in principal business districts.

16. Fire behavior in uninhabited areas following nuclear attack would be basically no different from the behavior of wildland fires in peacetime.

17. City fires spread at about the same rate as forest fires.

18. Fire spread over periods of six hours or longer is much slower than is popularly assumed.

19. Over long periods of time, fires travel fastest over level ground; upslope, next fastest; downslope, slowest.

20. Rate of spread depends on the length of time over which the spread is measured.

21. On large fires, the head fire moves on the average, three times the rate of the flanks and seven times as fast as the rear.

22. The shape of initially ignited areas will not be circular unless the kindling fuels are uniformly distributed.

23. Weather is a controlling factor in the ignition of wildland fuels but is of less importance in determining the incidence of primary fires occurring within the exposed buildings.

24. Except under very unusual circumstances, fires will not spread more than five-ten miles in any direction from the area of initial ignition.

Models:

1. Fire spread models currently available for urban or rural areas do not presently consider the total fire damage picture but only the damage resulting from attack by a single weapon.

2. Fire spread models do not currently include consideration of fire brands as a spread mechanism.

Vulnerability of Humans:

1. Fallout shelter occupants may be exposed to fire from several sources and must therefore be given adequate protection from fire until evacuation is possible.

2. Shelters that are under or adjacent to, heavy fuel loading

may become untenable if fires are not controlled.

3. Elimination of toxic gases and insuring adequate ventilation are two important problems to solve in providing safe conditions for shelter occupants.

4. Immediate, effective evacuation measures may well be impossible in situations where high yield weapons produce large areas of initial and secondary ignitions.

Countermeasures:

1. Shielding is an important deterrent to initial ignition following a thermal pulse.

2. The ground point where maximum thermal protection is needed from a high altitude weapon burst is directly below the detonation.

3. An effective thermal attenuation system must be capable of reducing a thermal flux by a factor of ten.

4. Effective smoke screening depends upon adequate warning time. Warning time, may vary from two-three minutes up to 30 minutes or longer.

5. New information developed on smoke screen generator spacing indicates fewer stations are required than was previously estimated.

6. Since thermal attenuating smoke screens would be needed mostly in target fringe areas, a careful analysis would need

to be made to determine where the systems would be installed.

7. A trained shelter manager and his immediate staff, working with a number of task teams (a fire team is suggested) offers the best combination for effective shelter management.
8. Shelter for protection equipment requirements may be stated in terms of square feet of shelter area.
9. Public acceptance of promising countermeasures is necessary since most countermeasures would not be effective unless incorporated on a large scale.

<u>Organizing to Suppress Post-Attack Fires:</u>

1. Urban fire departments would be inadequate to effectively fight post-attack fires.
2. Room fires can be effectively controlled by teams of trained individuals acting quickly following nuclear attack.
3. Adequate pre-attack planning will measurably reduce the number of fires resulting from enemy attack.
4. The existing fire services could provide effective leadership in training prior to, and command during, mass fire situations.
5. A properly trained and equipped general public will be needed to help combat initial and secondary ignitions resulting from enemy attack.

6. Disaster organizations should be staffed with persons having professional fire experience.

7. <u>Time</u> is important from the standpoint of fire detection, occupant response to alarm, and building evacuation; and should be emphasized in all training relating to shelter fire protection.

8. Fire suppression equipment standardization will help make mutual aid more effective. In a disaster situation, trained fire service personnel are apt to end up working on equipment that is strange to them.

APPENDIX G

DEVELOPMENT SCHEDULE FOR THE FIRE DEFENSE PROGRAM

GPO 808-375